SCIENTIFIC AMERICAN

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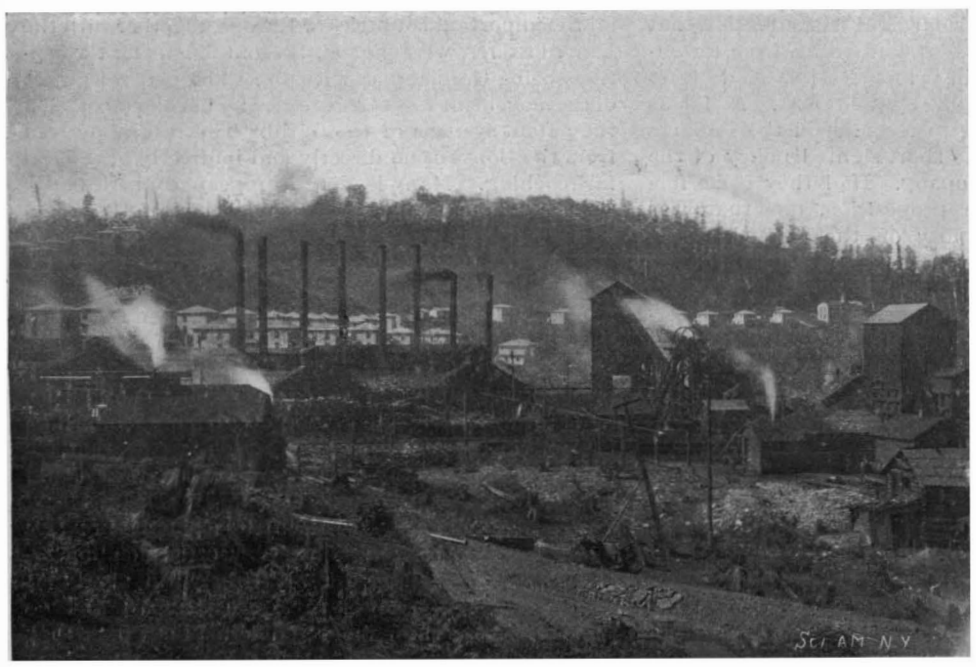
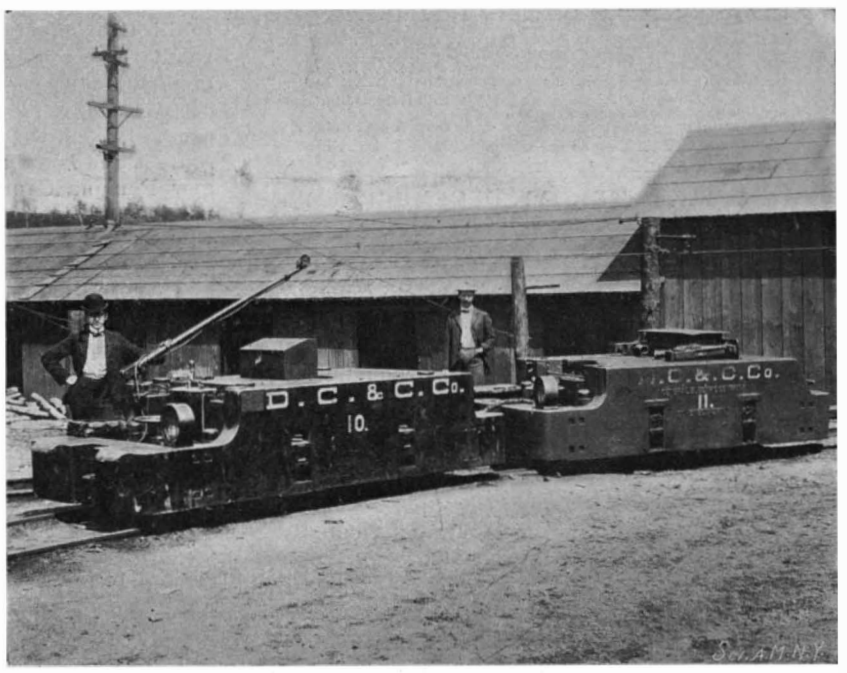
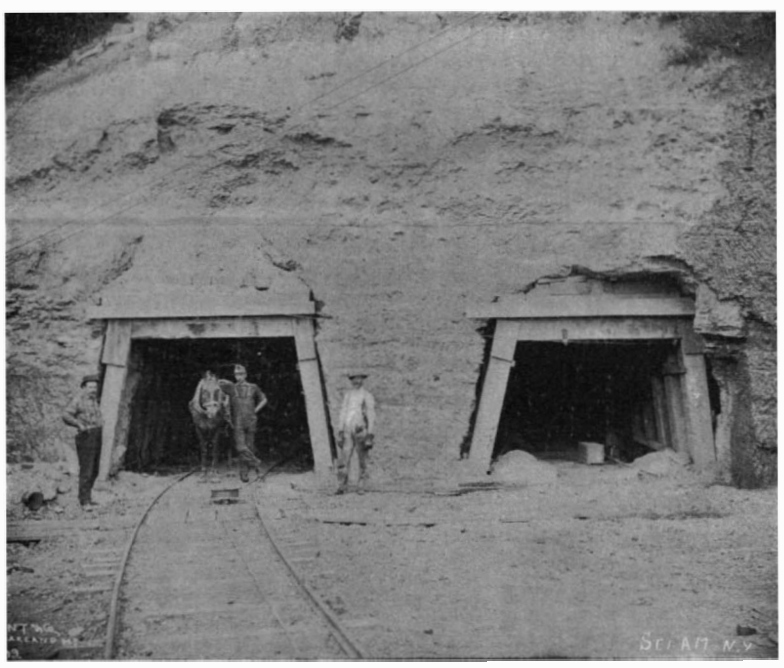


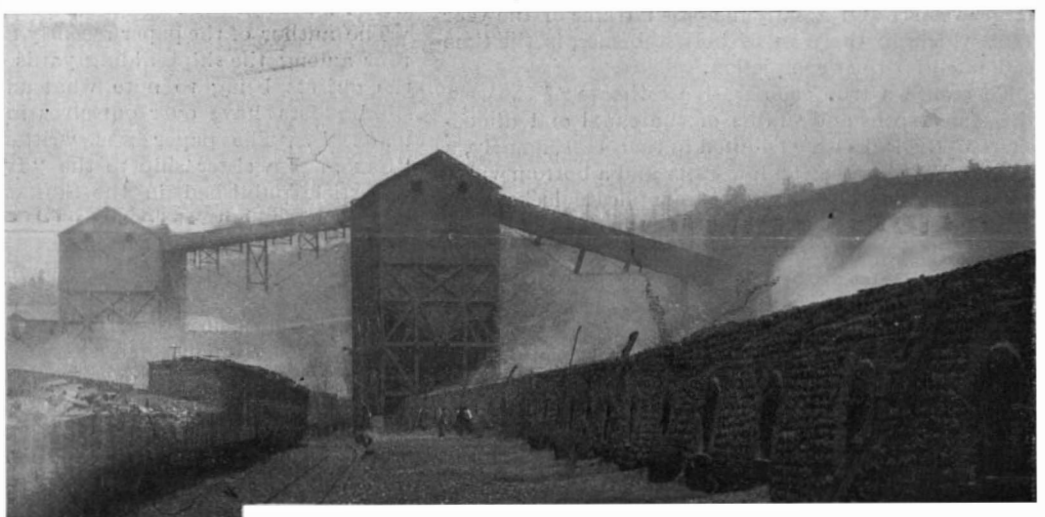
Mining Village, Showing Tipple and Miners' Cottages.



Electric Mining Locomotives.

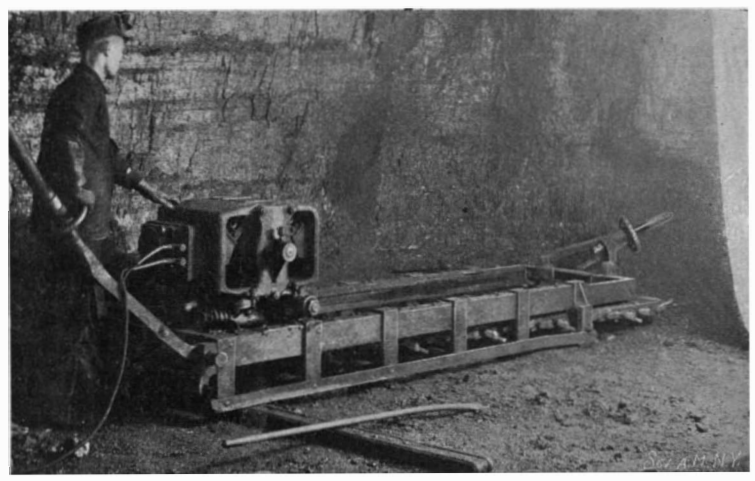


Mine Entrance on Side of Hill.



Coal Mine in Connection with Coke Ovens.

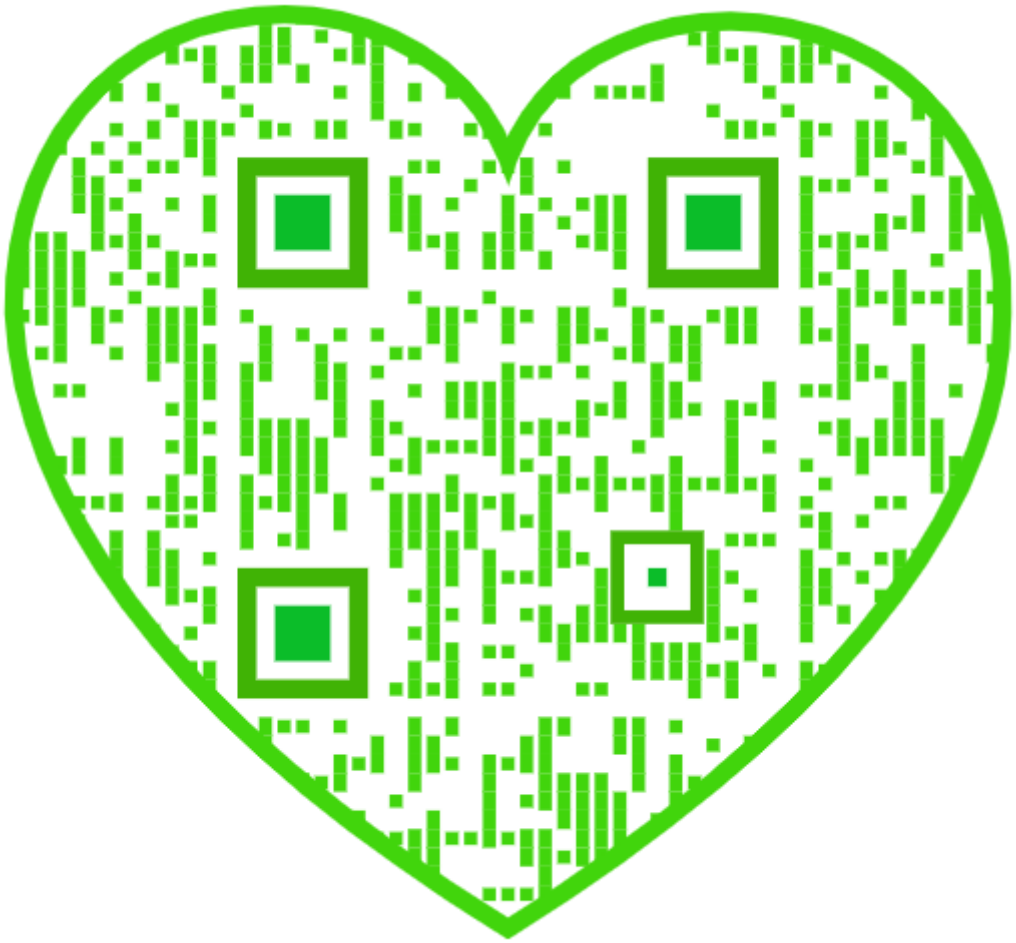
Tipple Loading Three Cars at Once.



Electric Coal-Cutter.

Electric Coal-Mining Machine at Work.

MODERN SOFT COAL MINING AND HANDLING.—[See page 374.]



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NEW YORK, SATURDAY, DECEMBER 15, 1900.

REPORT OF THE ISTHMIAN CANAL COMMISSION.

The preliminary report of the Isthmian Canal Commission, recently transmitted to Congress by the President, would seem, on the face of it, to be somewhat self-contradictory, for the reason that although its facts and figures show that from an engineering point of view the Panama Canal is more advantageous and cheaper to construct, it is recommended that the more costly Nicaragua Canal be built. The estimates of the cost of the two canals are about fifty per cent greater than the estimates of the International Commission which recently examined the Panama Canal and the estimate put in last year by the Walker Commission for the Nicaragua scheme. This increase, however, is not due to any underestimate by either of these commissions, but results from a great enlargement of the scope of the plans for both enterprises, such enlargement being necessary to render them available for the larger vessels and greatly increased traffic of the year 1910, which, in the case of both schemes, is the time estimated for their completion.

To secure a true comparative estimate of the cost, the same depths and widths of the canal and dimensions of the locks were adopted in each case, namely, a depth of 35 feet at mean low water and a bottom width of 150 feet for the canals, with duplicate locks, each 740 feet long, 84 feet wide, and 35 feet in depth. In the case of Nicaragua, the canal would be 186 miles long from ocean to ocean, and as a preliminary to construction 98 miles of double-track railroad, costing $7,350,000, would have to be built. The Panama Canal, which is about two-fifths completed, would be 43 miles in length. The total cost of the Nicaragua Canal would be $200,540,000, and of the Panama Canal $143,342,579. The time necessary to complete each canal would be about ten years.

The considerations which led to the choice of the Nicaragua Canal are as follows: Although the estimated cost of the Nicaragua Canal is some $58,000,000 more than that of the Panama Canal, to the estimated cost of the latter scheme must be added the purchase price of the rights and properties of the present Panama Canal Company, which, it is conjectured, would be enough to bring the total cost up to that of the Nicaragua scheme. Judged from the standpoint of advantages of operation, the Panama Canal would be the shorter, it would contain fewer locks, the summit elevation would be less, and—a most important consideration for navigation—there would be less curvature. The average time of the passage from ocean to ocean would be about twelve hours as compared with thirty-three hours for the transit of Nicaragua. As offsetting this advantage, it is pointed out that as far as the interests of commerce are concerned, the sailing distances from port to port via Panama would be greater. The voyage from San Francisco to New York would be 377 miles longer by Panama than by Nicaragua; from San Francisco to New Orleans the distance would be 579 miles greater, and to Liverpool 386 miles greater. These longer sailing distances would more than offset the shorter time of passage through the Panama Canal, at least so far as United States commerce is concerned, and the report states that this difference would be sufficient to offset the greater cost of maintaining the longer canal.

The question of the construction of the Panama Canal by the United States government is greatly complicated by the fact that the concession by Colombia to the present Panama Company is exclusive, and that it will be in force for many years to come. The commission is of the opinion that any concession of rights by the government of Colombia to the United States by agreement with the new Panama Canal Company is, for various reasons, impracticable. Although no formal reply has been given by the Panama Company to the request of the commission for a statement of the terms on which it would dispose of its property to the United States, the report states that the company does not appear to be willing to sell its franchise, but is rather disposed to allow the United States to become an owner of part of the stock, a situation which will scarcely commend itself to our government. As against these difficulties and objections, it is to be noted that the governments of Nicaragua and Costa Rica are not hampered by any existing concessions.

Until the full text of the report is available, it will be premature to enter into any extended review. As it is, enough of the report has been made public to show that it would have been better to have awaited its publication before taking any such definite legislative action for the immediate construction of the canal as is contemplated by the Hepburn bill. The SCIENTIFIC AMERICAN has always strongly advocated a conservative course on the part of Congress with regard to this most important scheme; and its contention that the Panama route would be found to be, from an engineering standpoint, the most feasible and least costly, seems to be borne out by the report. As far as can be judged, the failure to recommend the Panama route is due largely to the short-sighted policy of the new Panama Canal Company. Had they come forward with a reasonable proposition, one that was consistent with the dignity of the United States government, it is quite possible that the shorter route, with its many obvious advantages, would have been adopted; but as the matter now stands, we certainly think that the attitude of the French owners has been such as to render the recommendation of the Nicaragua route the only logical course open to the commission.

THE RELATIVE COST OF STEAMSHIP CONSTRUCTION IN EUROPE AND AMERICA.

Among the papers presented at the recent general meeting of the Society of Naval Architects and Marine Engineers in this city was one by Mr. George Dickie, of the Union Iron Works, San Francisco, on the question "Can the American Shipbuider under Present Conditions Compete with the British and German Shipbuilders in the Production of the Largest Class of Ocean Passenger and Freight Steamships?"

The author of the paper recently made an extensive tour among the shipbuilding yards of Europe, one of the objects being to note what advantages foreign shipbuilders have over ourselves in skill, labor and materials. The paper was written on board the "Saxonia," a sister ship to the "Ivernia," which, in an article published in the SCIENTIFIC AMERICAN of November 10, was taken as the latest representative of the large cargo and passenger steamers which are becoming increasingly popular among the shipowners of the present day.

Mr. Dickie's comparison between British and German and American methods is made under three heads: skill in design, cost of labor, and cost of material. As regards the question of skill the British designers labor under the severe restrictions of Lloyd's Register, and Mr. Dickie gives them full credit for a thorough understanding of their profession and great skill in turning out economical designs that conform to the rigid requirements and restrictions of the Register. Given an American register of shipping that would lend itself more readily to the tendencies of American design, Mr. Dickie believes that the American architect will show himself to be quite abreast of his British cousin. As regards the cost of labor, it is shown that under our present methods labor cost in the United States is 25 per cent greater on the hull and 50 per cent greater on the machinery of an average ocean-going freight or passenger steamer.

It is just here, in discussing the cost of marine machinery, that the author brings out a fact which will be certainly very astounding to those of us who have believed that in economy of shop management we are far in the lead of Great Britain. As an explanation of the cheapness of British marine engine construction, he tells us that every part of the engine in a first-class establishment is made to gage, and when finished by the tools is sent to an expert examiner at a large surface table, who determines if every operation performed by the tools has been accurately done. If the work is not perfectly accurate, it is returned for correction or, if not worth correction, it is entirely rejected. "The pieces thus produced that go to make an engine when brought together, are not erected by fitting each piece to its place by file or chisel, but they are placed in stock ready to be assembled in a few hours on receipt of an order for an engine of the size they represent." The author is of the opinion that the introduction of a system to insure correct tooling on every piece entering into the construction of our marine engines would reduce the cost of erection by one-half. The full text of this valuable paper will be found in the current issue of the SUPPLEMENT.

REPORT OF THE COMMISSION ON PATENTS AND TRADE MARKS.

In our last issue we referred editorially to the fact that the Commission appointed by the President under act of Congress to revise the laws of the United States concerning patents and trade marks, had been holding a final session in the city of New York, preliminary to presenting to Congress bills for modifying and harmonizing the present patent practice and trade-mark laws with existing conditions. Through the courtesy of one of the members of the Commission, it has been our privilege to examine the report of the Commission and the bills, which have been most carefully drawn. It will only be possible to summarize briefly the general scope of the bills, rather than to pass any criticism upon them at the present time.

It will be remembered that the treaty of agreement which has been generally known as the "International Convention for the Protection of Industrial Property" was concluded at Paris in March, 1883, in which nearly all the important countries of Europe, together with the United States, were parties, the only important exceptions being Germany and Russia. The general object of the movement was to secure greater harmony between the patent systems of the world. The results derived from the Convention directly and indirectly have been far-reaching. Many leading European countries have since 1883 practically rewritten their laws in the direction of far greater liberality toward inventors.

No less than seventy-one countries have patent laws, and the general features of these laws, with particular reference to the differences existing between them and the United States, are clearly presented in the report. For instance, in many foreign countries patents are granted without investigating the question of novelty. Many countries require inventions to be unknown to the public up to the day on which application for patent is filed; many inventions, such as foods and medicines, which are patentable here are excluded from protection in most foreign countries; patents in many foreign countries date from the day of application instead of from the date of issue, as here; in nearly all foreign countries annual taxes are required to keep patents in force throughout the terms for which they are granted; patented inventions are required in foreign countries to be manufactured on a commercial scale within a short time after the grant of the patents on pain of forfeiture, and owners of patent rights may be compelled to license others to make and use the patented inventions.

None of these features should, in the opinion of the Commissioners, be incorporated into the United States patent system. There is no doubt, they say, as regards its essential features that the United States patent system is the best which has been devised up to the present time. But in some matters not affecting the essential principles of the system the Commissioners find certain features of the foreign laws desirable. These are, first, that foreigners who take out patents here should have in this country a representative on whom papers may be served in any suit affecting their interests; second, to render a foreign patent, as a bar to the grant of patent here, the same weight as any other disclosure—that is, if printed, the patent should be given the effect of a printed publication, and if not printed (and in many foreign countries patents are not printed and may even be kept secret), it should have no other effect than that of knowledge or use of the invention in the country in which it was granted; third, to provide that a mere application for a foreign patent shall not be a bar to the grant of a patent here; and fourth, that in case of an interference, if it is shown that the later applicant is the real inventor, the patent shall be granted only for the unexpired term of the first patent.

Furthermore, under the present laws, caveats can be procured only by citizens of the United States. The Commission considered that if caveats are still permitted to be filed, foreigners as well as citizens should be permitted to file them, but they recommend, in view of the fact that caveats are generally regarded as of no practical value, that the law which provides for them be repealed. They also recommend that the executors or administrators of a deceased inventor, even though appointed abroad, be permitted to apply for a patent for the invention. As the law is now construed in such a case, auxiliary letters of administration are required to be taken out in this country. This amendment seems to be broad-spirited, and will do away with many of the formalities which now render it difficult and expensive for a foreign administrator to file or prosecute an application in this country.

The report may properly be divided into two parts, namely, that which refers to modifying our present patent laws to conform with the Convention, and secondly, and by far the more important part, that which relates to reforming our present trade-mark practice. Our present practice is causing widespread discontent; and now that our merchants and manufacturers are engaged so extensively in foreign commerce, the importance of having a simple system of trade-mark registration is imperative, and it is to be hoped that this all-important question will receive the intelligent consideration of Congress and that the much-sought-after relief which is looked for by the industrial community may be found.

THE TRADE MARK BILL.

The Commissioners have made a careful study of the trade-mark laws of the principal foreign countries. Trade-mark laws are found to fall into two general

classes. First, those known as "declaratory," in which the right to the mark is acquired by actual use of the mark or brand in trade; and secondly, those known as "attributive," which make the ownership in the mark depend upon the act of registration, the first who presents the mark for registration becoming, by that act, the owner of the mark, irrespective of the fact of his having previously used the mark or not. Many foreign laws, like that of Germany, are of this character. In foreign countries generally registration is recognized as of great importance to the public, as notice of what trade marks are claimed as the subject of exclusive right, and every effort is made to induce owners of trade marks to register them. The registration fees are made very much smaller than in this country, being in a number of countries less than $5, while $25 is required here. The procedure of registering is generally much simpler than here.

The report contains a lengthy review of the constitutional power of Congress to provide for the registration and protection of trade marks used in interstate commerce. The conclusion is that Congress has this power, under the commerce clause of the Constitution.

It is to be regretted that the Commission have not agreed upon a single bill embodying their views. Judge Grosscup and Mr. Forbes, of the Commission, have submitted a proposed bill, and Ex-Assistant Commissioner Arthur P. Greeley, agreeing to the principal features of the bill of his colleagues, has drawn up a bill of his own which has been separately presented. These bills have been introduced into the Senate by Senator Pritchard.

The bill recommended by Judge Grosscup and Mr. Forbes was introduced on December 5, S. 5027. Mr. Greeley's bill is S. 5026. In the former bill it is proposed to regulate and protect trade marks, to enforce the treaties regarding the same when used in interstate commerce or foreign trade by registering them, for making the willful infringement of a registered trade mark punishable by a fine of not more than $500. The bill also provides for the seizure of goods bearing a false mark, and provides very fully for the regulation of commerce, both interstate and foreign. The fee for registration is reduced to $10, and the procedure necessary to secure registration is made as simple as possible. Practically all marks which could be considered good trade marks at common law are made registrable.

The bill of Mr. Greeley is in harmony with the features of the majority bill in respect to permitting the registration of marks used in interstate commerce, in reducing the registration fee to $10, in simplifying the procedure necessary to registration and providing additional remedies for the registration beyond those now secured under the common law, but does not include the one very important particular of making the title of ownership *depend* upon the act of registration.

The preparation of this report has taken an immense amount of labor on the part of the Commission, covering a period of more than two years. An unusual feature of the work is the fact that the Commissioners serve without compensation, the total appropriation for the expenses of the Commission being but $250.

It has been possible only at the present time to make a statement as to the provisions of the bills. It is not possible at the present writing to take up for consideration the merits of the proposed legislation.

SHOOTING AT THE CLOUDS.

The practice of "shooting at the clouds" with cannon or other specially constructed contrivances for the purpose of dispelling threatened hail storms is rapidly changing from the odd to the commonplace throughout Europe. In Continental newspapers one reads at present of the systematic use of artificial storm destroyers in almost every country where agriculture forms the chief mainstay of prosperity. In many parts of France, Italy, Germany and Austria, the custom has grown so extensively that it often forms an official department of the municipality. In such cases, with the assistance of the neighboring landowners and farmers, thorough systems have been devised, until the elements have become so firmly harnessed that it is almost impossible for them to inflict injury or destruction to crops.

Indeed, so widespread is the public interest in this valuable aid to agriculture at present that the leading agricultural societies have taken up the subject, with a view to contributing to the means already employed the results of their minute investigations. In Vienna recently a congress of the members of the Meteorological Institute was called, at which the various methods of cloud shooting were exhaustively discussed and many new experiments were inspired, which cannot fail to be of great benefit to the farmers in the districts peculiarly susceptible to the ravages of hail storms.

From the report of the proceedings of this congress, it seems that the idea of averting storms by means of cannon shots is not a new one in Austria. It was first introduced during the reign of Empress Maria Theresa, who issued a decree prohibiting the use of cannon by the peasantry shortly after the adoption of the practice. In time, however, this decree was overruled, and in the year 1896, the burgomaster of Windish-Feistritz, in Styria, again introduced the method in Austria, substituting in place of the ordinary cannon a new weapon. This consisted of a funnel-shaped barrel of sheet iron, 6½ feet long, and 79 centimeters (26 8 inches) in diameter at the muzzle and 20 centimeters (7·8 inches) at the base. The idea of the broad muzzle was to distribute the discharge over greater space and thus to increase the effect. So successful were the results attained by the burgomaster's experiments that in 1897 the municipality of Windish-Feistritz counted no less than thirty shooting stations; since when there have been no hail storms whatever in that locality.

Nowhere, however, has cloud shooting found such general usage as in the vicinity of Venice, Lombardy and Piedmont, districts that formerly suffered fearfully from the destructiveness of hail storms. During the summer of last year there were at least 2,000 stations, built on the plan of those constructed in Styria. At a congress held a short time ago in Casale Monferrato it was found that in numerous localities where shooting stations had not been introduced, hail storms were still of frequent occurrence, causing immense damage to crops and property, whereas the districts protected by artificial means were entirely free from loss from such causes.

In a speech delivered before the Vienna Meteorological Institute in Vienna a few weeks ago, Burgomaster Stiger, the originator of the present method, gave some interesting facts regarding his first experiments with the cloud-shooting cannon. He began his experiments with the fundamental principle of disturbing the intense stillness preceding a hail storm. In view of the established fact that there is no physical reason why sound waves should exercise an effect on the formation of hail, Stiger determined that it would be necessary to confine his operations to creating a form of whirlwind. An official trial in 1897, conducted by an expert, demonstrated that after the firing of a shot a small whirlwind arises, easily perceptible in the reflected sunshine. This whirlwind ascends with a piercing whistle, the sound lasting for 13 seconds in day time and 20 seconds at night.

During this experiment it was noticed that a swallow which flew within the radius of one of these whirlwinds instantly dropped dead. On examination the bird had the appearance of being shot.

The mechanical energy created by the wind thus produced, upon which Stiger laid great stress, found few supporters in Europe until at the congress in Casale, Italy, a Prof. Roberts reported that at a distance of 240 feet the wind had destroyed a strong diaphragm. Thereafter several experiments held at St. Catherine demonstrated that the whirlwind was the main if not the sole agent in diverting hail.

Some careful experiments were carried on in Austria during the early spring, mention of which may also be of interest at this point. The experts who attended the exhibition could plainly see the wind rise from the mouths of the funnels with lightning rapidity, possessing all the aspects of a shot. When large cannon were used, whistling could be heard for 20 to 28 seconds. The most marked effects, however, were produced by horizontal shots. For the experiments, shields built of thick paper and linen were placed at intervals of 40, 60, 80 and 100 yards from the mouth of the cannon. When the circle of wind enfolded these shields, the heavy linen and paper were torn from the frames, the solid posts and framework snapped in two and cast from 18 to 22 yards, while a large mastiff standing near was lifted into the air and after turning several rapid somersaults hurled against the ground with such force that his interest in cloud shooting demonstrations was effectually dispelled.

It is calculated that these artificial whirlwinds carry their energy to a height of 1,600 to 2,000 yards, thus accounting for their effect on the clouds. As regards the creation of the wind, the explanation is that the air circulating in the mouth of the funnel is set in motion by the explosion of the powder and hurled forth in a ball that expands upon leaving the funnel until its full force is reached some distance overhead. In actual operation rapid firing is avoided, its effect being to diminish the force of the wind. The shooting must be done during the quiet preceding the storm. Only quick matches or fuses should be used, percussion caps and similar inventions being barred.

ALCOHOL AS A FUEL FOR MOTOR CARRIAGES.

A novel experiment has just been carried out by the Moto Club of France—the new automobile institution recently organized in Paris in competition with the older society—for the purpose of proving the efficacy of alcohol as a fuel in place of petrol. The mineral oil has to be imported into the country, and costs at the present time 14 cents per quart, while occasionally, owing to the development of the motor car industry, it has increased to as much as 16 and 20 cents per quart. Since alcohol is a product of the country, being extracted from beetroot, it is naturally a much cheaper article, costing only 10 cents per quart. The pure spirit, however, owing to the prohibitive excise duties, cannot be employed for fuel, but it can be utilized as methylated spirits, or even mixed with benzine. The test with this fuel was carried out over a route 88 miles in length, extending from Porte Maillot to Rouen, the course abounding with rough roads, ill-paved streets, and many stiff gradients. The object of the experiment was to ascertain the efficiency of the spirit, and was not a speed test trial. Nevertheless, some of the fifty-one competitors raced throughout the journey, one vehicle covering the total distance in two hours and a quarter. Every car that participated in the contest reached the destination without the slightest mishap, a fact which in itself conclusively established the efficiency of alcohol as a fuel for automobiles. The exact merits and demerits of the spirit, however, for this purpose will not be made known for some time, since exhaustive investigations are to be made regarding the consumption of alcohol by each vehicle during the journey and the relative power developed by the engines.

THE DIRECT COMBINATION OF ALUMINA AND OXIDE OF CALCIUM IN THE ELECTRIC FURNACE.

Messrs. Moissan and Dufan have recently undertaken a series of experiments upon the direct combination of alumina and oxide of calcium in the electric furnace, and in this way have succeeded in forming the monocalcic aluminate ($Al_2 O_4 Ca$) in crystalline needles. This body has been only imperfectly studied; several experimenters claim to have obtained it, but their results have lacked certainty. The experimenters pursue the following method, which is the subject of a paper read before the Académie des Sciences. By heating in the electric furnace an intimate mixture of 100 parts of well calcined alumina and 60 parts of anhydrous lime, with an arc of 1,000 amperes and 45 volts, after three minutes' action a gray mass, entirely melted, is found in the crucible, which upon breaking is found to be composed of an assemblage of fine brilliant needles. In the cavities of the mass some of the free needles attain one-eighth of an inch in length, and may be taken out and examined under the microscope. The product is freed from excess of lime by a series of washings with alcohol and ether, and dried in vacuo. In this way a crystalline powder is obtained which by analysis gives very nearly the theoretical quantity for the formula $Al_2 O_4 Ca$, and it is thus found to be the monocalcic aluminate. The needles are colorless and transparent, appearing to be oblique prisms with rectangular base. This body does not scratch glass; its density is found to be 3·671. The aluminate of calcium is quite stable in dry air, but water attacks it easily, with dissociation and precipitation of alumina. It is quickly attacked by hydrochloric acid, but nitric, sulphuric and hydrofluoric acids act more slowly. Fluorine, which is without action in the cold, attacks it when heated, with incandescence and formation of white fumes. The halogen elements and sulphur are without marked action at a moderately high temperature. Carbon only acts upon it at the temperature of the electric arc, with formation of carbides.

ELECTRIC TRAMWAYS IN LONDON.

The construction of the first electric tramway in London is rapidly approaching completion. The London United Tramways Company have dispensed with animal traction throughout the whole of their system, and hope to begin their service with the new plant within the course of the next few weeks. The enterprise originally met with powerful opposition, but convincing proof will soon be displayed regarding the many superior advantages of electricity over any other system for the propulsion of street tram-cars. This company has forty miles of track through the southwestern suburbs, and powers are being sought by the company to extend the service another sixty miles, so that in all they will serve one hundred miles of streets. If this scheme is successfully carried out, this company will be the largest and most powerful tramway concern in the whole country. The overhead trolley system has been adopted. Great objection was first raised to this system on æsthetic grounds, but after careful consideration, it was decided that this principle possessed numerous advantages over the conduit system, which would occasion great inconvenience to the traffic in the streets while the conduits were being installed, and also whenever repairs were necessary. The company have endeavored to disfigure the streets as little as possible by erecting slight, ornamental tapering poles. The cars are constructed after the most modern designs to insure the maximum of comfort. They each have accommodation for seventy passengers, as compared with forty-four passengers upon the animal traction cars—forty outside and thirty inside. The cars are well upholstered and illuminated with the electric light, while numerous electric bell pushes are provided, so that the attention of the conductor may be attracted when a passenger desires to alight. Now that the idea of electric traction has been adopted upon one tramway in London, there is no doubt that the County Council will convert their systems to electricity in the near future.

CURIOUS KNOT FORMATION.

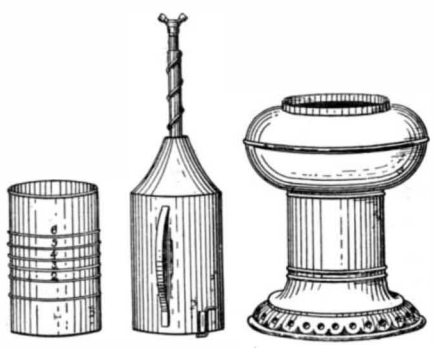
We are indebted to one of our correspondents, Mr. R. C. Wagner, of Jonesboro, Ind., for the accompanying illustration of a very curious knot formation. It was obtained from a swampy ash tree and was sawn off from the tree about 20 feet from the ground. The remarkable thing about it is its resemblance to the

CURIOUS KNOT FORMATION.

head of an aged woman, the various rings forming the receding planes which simulate the eye sockets and the mouth. The wood which forms the right eyeball is loose and can be moved around like a human eye. The knot is about as large as the average human head. The negative was not retouched. This curious specimen is now in the possession of Mr. B. Coleman, of Jonesboro.

A SIMPLE PORTABLE ACETYLENE HOUSE-LAMP.

The general public having convinced itself that calcium carbide is no more dangerous than kerosene and gasoline and that the brilliant white light of acetylene is far preferable to the weak, yellow flame of oil, it is



THE THREE PARTS OF THE LAMP.

not astonishing to find that acetylene is no longer restricted to the carriage and bicycle lamp, but is now used even in the house-lamp. The simplest lamp of this kind which has been brought to our attention, and perhaps the first produced by an American manufacturer, is made by the Badger Brass Company, of Kenosha, Wis.

AN ACETYLENE HOUSE-LAMP.

The lamp in question, as our illustration shows, consists only of three parts, a carbide-holder, a gas-chamber, and a lamp-base which serves as a water-reservoir. The carbide-holder is merely a cylindrical vessel, through the bottom and along the inner wall of which vertical feed-tubes extend. The holder is graduated, so that it can be readily determined how much carbide must be employed to yield a light for a time which may vary from two to six hours. The gas-chamber is a cylindrical vessel provided with a conical top through which a burner-tube extends, and is of such size that it can snugly receive the carbide-holder, the two sections telescoping with each other. On the sides of the gas-chamber springs are secured, which serve the purpose of engaging the wall of the water-reservoir so as to center the gas-chamber. The burner-tube is provided with a spiral rib which serves as a thread and co-acts with the shade-holder, to raise and lower the gas-chamber and water-reservoir.

When the water-reservoir has been filled, when the carbide holder has received its charge and has been thrust into the gas-chamber, and when the gas-chamber and carbide-holder, thus combined, have been slipped into the water-reservoir, the lamp is ready for use. By turning the shade-holder, which engages the rib or thread of the burner-tube, the gas-chamber and carbide-holder are lowered, whereby the water is forced up through the feed-tubes of the carbide-holder to the carbide. The water in the reservoir serves the double purpose of generating gas and of keeping the lamp cool. In order to extinguish the light, the shade holder is turned so that the carbide-holder and gas-chamber are raised. The water-level and pressure being thus reduced, the generation of gas ceases. It is therefore evident that the light can be as readily controlled as in any oil-lamp.

NEW TELEPHONE METER.

A successful telephone meter solves one of the most important problems connected with the telephone exchange. Where the service is measured or graded according to the number of calls, and where there are pay stations, the keeping of a record of these calls entails considerable labor upon the operators and distracts their attention from their other duties. In general, telephone meters may be divided into three classes: first, where they are located at the subscriber's end of the line only, and where they are controlled or supervised by the central office operator; second, where the meter is located in the central office and worked manually by the operator or automatically; and in the third class there are duplicate registers at the subscriber's station actuated simultaneously by the aid of the subscriber or operator.

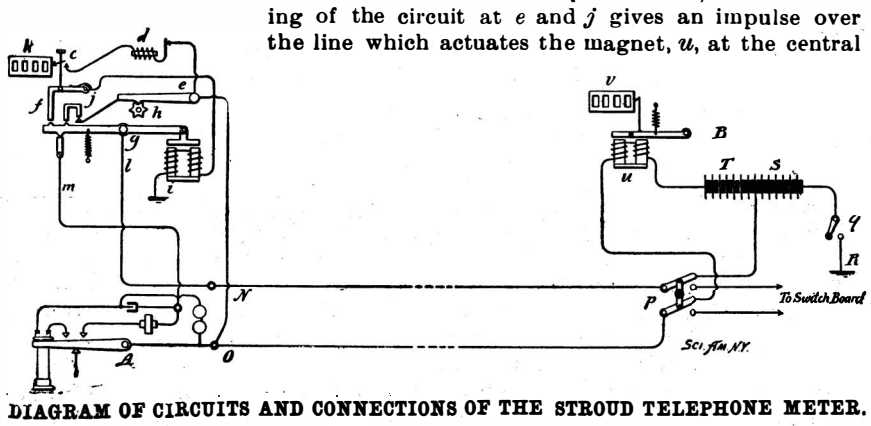


DIAGRAM OF CIRCUITS AND CONNECTIONS OF THE STROUD TELEPHONE METER.

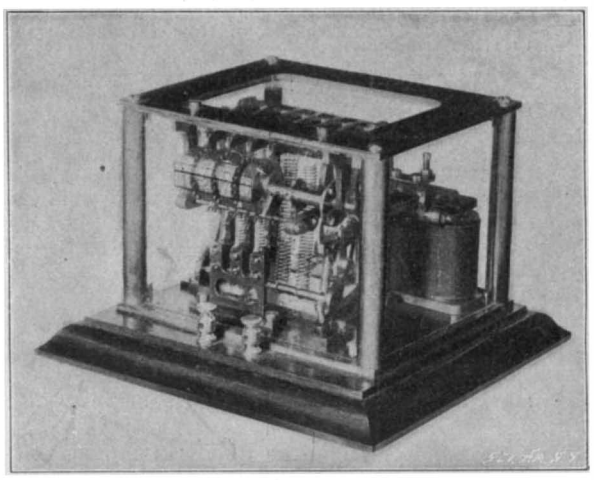
In meters of the first class, there is considerable expense and inconvenience in visiting the various telephone installations, in order to take the state of the meter. The second method is as unsatisfactory to the subscriber as is the ordinary system of keeping a record with a pencil, as the latter has no means of verifying his bill. This is also the disadvantage in the third system.

The Stroud telephone meter, which we illustrate, is made by the National Measured Service Company, of Chicago, and is designed to obviate these objections. In this system a permanent meter is not required at the switchboard for each line, one portable instrument doing all the work. It can be used with either the local or common-battery systems. Each outgoing call is "stored," as it were, at the instrument from which the call emanates, so that the operator need not be concerned as to who makes the call. At the end of any given time the registered number of calls can be transmitted electrically to the central station at the pleasure of the operator who is taking the state of the meters.

Our diagram shows the connections. Of the two other engravings, one illustrates the meter attached at a subscriber's station, and the other the recording instrument at the exchange.

In the diagram, *A* represents the register at the subscriber's end of the line, and *B* the counter with the battery connections, etc., at the central station. The meter is operated as follows: The subscriber at *A* removes the receiver from the hook, thus calling central; he then gives the number desired, to the operator. As soon as the person called responds, the operator asks the one calling to press the button, *c*, which must be done before the conversation begins. The operation of pressing the button sounds the buzzer, *d*, by closing the circuit from *O* through *f* by being brought into contact with *g* and thence to *N*. The same motion of the button, *c*, simultaneously rotates the counter one number forward and rotates the camwheel, *h*, to which is connected a spring, thus winding the spring and as it were "storing" the call.

At the end of any given length of time, when it is desired to take a reading from the meter, the operator who has charge of this branch of the service disconnects the line to be read at a convenient point in the central office and attaches the cords of the reading instrument to the outgoing line, then rings the subscriber up and requests him to press the button, *c*, which closes the controlling circuit, *c*, through the coil, *l*, through *f* and *g* to *N* and thence to *p* and through the limb, *S*, of the battery and the switch, *q*, to the ground, completing the controlling circuit and energizing the magnet, *l*, which draws down its armature and closes together the contacts, *e* and *j*, also maintaining the connection made at *g* and *f* by the act of pressing the button. The energizing of the magnet, *l*, also releases pawls which check the spring connected with *h*, and the latter rotates backward, giving motion to the arm, *e*, which intermittently closes the circuit to *j*. The number of strokes of the arm, *g*, represents the number of calls stored by the meter; thus the closing of the circuit at *e* and *j* gives an impulse over the line which actuates the magnet, *u*, at the central station, so that the calls have been transferred from the subscriber's meter to the recording and reading instrument at the central office. After each reading the counter, *v*, on the reading instrument is restored to zero by turning a button. The counter at the subscriber's end of the line does not reset, but continues to count up to 99,999 and then turns to zero, so that it is possible for the subscriber to see how many calls he has had in any given length of time, and also protects the company by maintaining a positive record, should any part of the apparatus fail in transmission or recording. The number on the receiving instrument after registering, added to the previous total, should tally with the number on the subscriber's meter. The device is a most ingenious one.

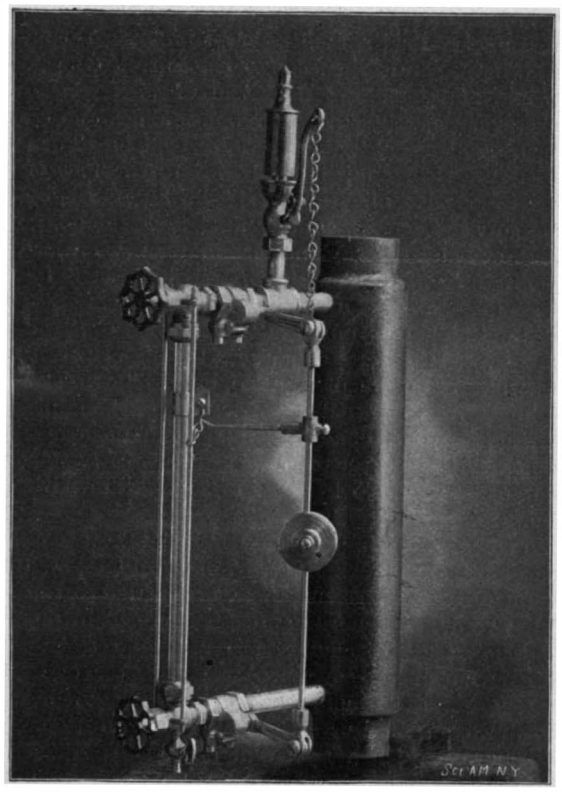


THE REGISTERING INSTRUMENT AT THE EXCHANGE.

SUBSCRIBER'S TELEPHONE WITH METER ATTACHED.

A SAFETY ATTACHMENT FOR WATER-GAGES.

Our illustration represents an automatic shut-off and alarm which is designed to cut off the water and steam should the gage-glass break, and to blow a whistle in order to call the engineer's attention to the accident. The device is the invention of William M. McLeish, of New Albany, Ind. The water-gage to which the improvement is applied comprises the usual water and steam inlet pipes connected by a glass. In the pipes are cut-off gate-valves whose stems are provided with arms connected with each other by a rod carrying an adjustable weight. On the rod a bar is adjustably secured by a set-screw. The free end of the bar rests on a support which embraces the glass. When the bar is thus supported the cut-off valves of the water and steam inlet pipes are normally held in open position. If the glass be broken, the support falls, and the weight on the rod connecting the arms of the cut-off valves moves down to close both valves so that the water and steam are shut off. The arm of the upper cut-off valve is connected by a chain with a whistle, so that when the weighted rod moves downward, the whistle will be blown to attract the attention of the engineer.



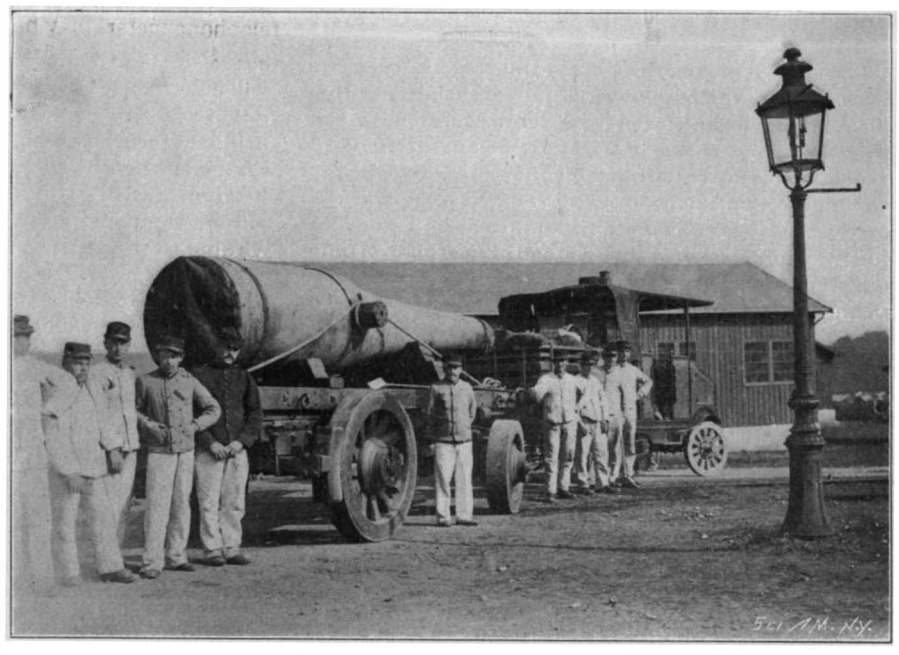
AN AUTOMATIC SAFETY ATTACHMENT FOR WATER-GAGES.

SCOTTE TRACTION ENGINE—TYPE SHOWN AT THE PARIS EXPOSITION.

The exhibit of military automobiles at the Army and Marine Palace shows the great progress which has been made in this direction of late. In France especially, where the automobile industry is now so well developed, it is natural that the Etat Major, which is always on the lookout for the latest improvements, should have given the subject considerable study; and the leading automobile manufacturers have been encouraged in the construction of types of machines especially adapted for army use. Thus the different machines at the Exposition include private vehicles for the officers, moto-cycles for carrying dispatches, mail and telegraph wagons, ambulances, and heavy traction engines. Among the latter the Scotte traction engine deserves special mention, as it is the type which has been used by the army for some time past and has been adopted after a very thorough series of tests. The illustration shows a general view of this machine, taken at the Versailles military station. The machine serves as a tractor or carrier, as it will carry in the rear a load of four tons, but in most cases it draws a train of heavy trucks or army wagons, and can transport from 10 to 12 tons useful load with an average speed of 4 to 4½ miles an hour on ordinary roads, while on good roads this speed may be increased considerably. The engine has a capacity of 27 horse power nominally, but this may easily be raised to 40 at starting or in hard places. A series of tests of this machine has been made at the Versailles headquarters from 1897 to the middle of 1899 under the direction of the superior officers of the artillery and engineering corps. The tests were made in as thorough a manner as possible, as it was desired to establish conclusively the relative advantages of steam and horse traction and obtain a series of data which would serve for future work. The tractors were accordingly put through a series of evolutions according to a carefully studied programme, and the data thus obtained are of great value, considering the high authority of the experts and thoroughness of the tests. The results leave no doubt as to the superiority of steam traction for the army, and it is likely to become an important factor in future operations. The first road locomotives used in the French army date from 1875, and were of English make; later on, a series of French machines of 18 and 12 tons were used. These, while they gave considerable service in hauling heavy material for the new forts and batteries, presented a great many disadvantages; according to the official reports, they were not powerful enough, presented great defects in maneuvering and direction, and were excessively heavy, so that they were of but little value in mounting grades, and besides they injured the road considerably. From this experience the Etat Major did not look very favorably upon steam traction; but since the tests made with the new machines they have quite changed their opinion, and the reports show that they are now very much in favor of the system, and consider that it will solve many important problems. It may be of interest to cite a part of the official report: "The traction engine, whose weight is not more than six tons, can pass over all of the classed roads in France without deteriorating them, and can enter into fortified places; when drawing a train of wagons, it can make turns of an interior radius of 11 feet and describes with facility all the desired curves. It has the great advantage that the existing rolling material may be drawn by horses or by the tractor without any change whatever; all the types of military vehicles may be thus drawn by the use of hitching devices adapted for the purpose." The photographs show the various purposes to which steam traction is applicable, one decided advantage being that of drawing long trains of wagons; this is shown in the view of the train of ammunition wagons, which is being drawn up an 8 per cent grade, the total weight being in this case 18 tons. In another view is a train of five provision wagons, showing the method of supplying an army in the field. A third view shows the transportation of a 10-inch siege gun to one of the large forts; the weight is here 25 tons.

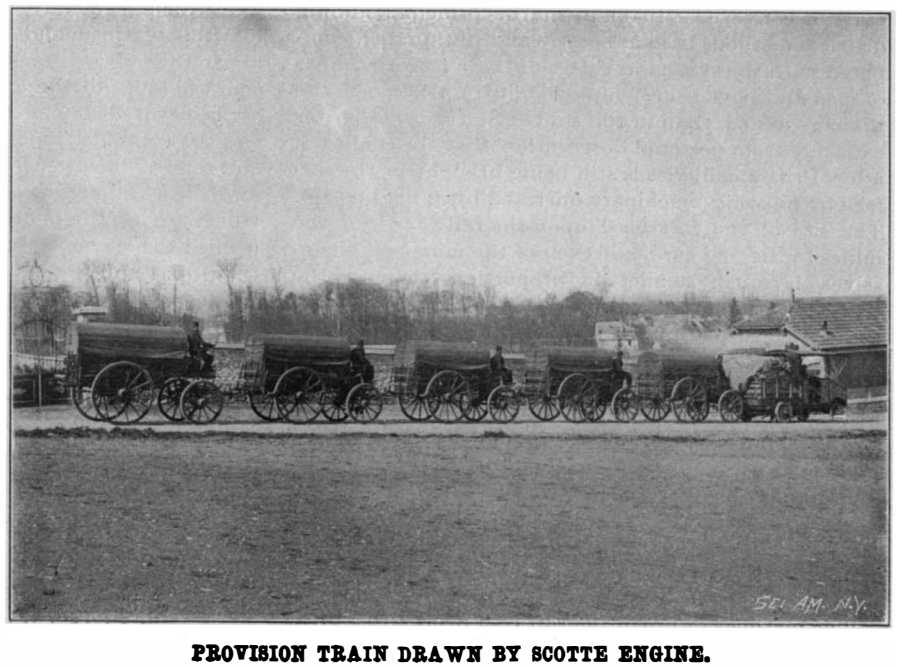
The reports have established some interesting data as to the advantages of steam over animal traction for army use. Suppose, for instance, that it is desired to transport 250 tons of material over a distance of 36 miles. Horses, drawing heavily loaded vehicles, can make at most 18 miles in one stage, and thus two sets will be needed to cover the 36 miles, making a relay in the center necessary. The tractor can, of course, cover the entire distance when supplied with fuel and water. In the case of horse traction, if each vehicle is loaded with 3 tons and drawn by 6 horses, as is usual

SCOTTE TRACTION ENGINE AT THE VERSAILLES ARMY HEADQUARTERS.



10-INCH SIEGE GUN, WEIGHING 55,000 POUNDS, DRAWN BY SCOTTE ENGINE.

AMMUNITION WAGONS ON 8 PER CENT GRADE—TOTAL WEIGHT, 18 TONS.



PROVISION TRAIN DRAWN BY SCOTTE ENGINE.

in army transports, 80 vehicles would be needed for the 250 tons considered, with 480 horses for one stage, or 960 horses for the two stages of the route. As to the personnel, the least number allowed requires one chief of the whole train, one officer or adjutant for each section of twenty vehicles, and four men per vehicle, making 325 men in all. As to the length of the train, allowing 60 feet to each vehicle, including the distance to the next, the line of vehicles will cover 4,800 feet of road. To feed the horses (counting 35 cents per day in France) will require an expenditure of $336, not counting the extra horses which always accompany a train of this kind. In the case of steam traction, 4 tons of useful load may be carried on the back part of the machine, and it will draw two vehicles loaded with 3 tons each, making 10 tons per train; thus to carry the 250 tons would require twenty-five similar trains, this being well within the limit, as the machine will take 12 to 14 tons. As to the personnel, each train requires one engineer, one fireman, and two men, and for the ensemble are needed one chief of expedition, two foremen mechanics and twenty men under them, making 150 men in all. The length of each train is about 90 feet, spacing them 30 feet apart, making a total of 2,250 feet. Each tractor consumes, for the 36 miles, $6 in combustible, etc., making the cost of transportation $150 for the whole. By comparing these figures with those for animal traction, there results an economy in personnel of 275 men, in length of train 2,550 feet, and in cost, $186. The advantage is thus decidedly in favor of steam traction. The Versailles commission conclude their report as follows: "This system may render great service in army transports of all kinds. In time of peace it reduces the expenses of haulage between military establishments and docks which are outside of the railroad system. In case of mobilization, when horses will be wanting, owing to the substitution of mechanical for horse traction in all the large cities, the tractors will be valuable for the various army transports."

MODERN SOFT-COAL MINING AND HANDLING IN THE UNITED STATES.

BY HENRY HALE.

Although the total shipments of soft coal in cargoes from the United States to foreign ports during the present year will probably not exceed six per cent of the total bituminous output in this country, the increase in export trade has attracted much attention, since the shipment is fully four times as great as that of 1898. It is calculated that the total soft coal production of the United States for 1900 will range between 170,000,000 and 175,000,000 tons.

The success of American coal exporters has been due to the prices which they have quoted, being less than those of European dealers. Several causes have contributed to the success of American competition, one of which has been the labor difficulties in Great Britain and on the Continent, which have largely curtailed the production. It is generally admitted, however, that the principal reason is the economical methods of mining and shipping the product, and the extent and richness of the American deposits. While the mines in Great Britain and Germany, for example, have been worked for centuries, many deposits in the United States have been opened but a few years. One of the principal items of expense abroad is in the construction of shafts and the elevation of the coal to the surface. Pits which extend vertically 1,000 feet to the mine workings are quite common in Lancashire, Staffordshire, and South Wales. As the beds of fuel have been worked out, shafts have been driven in some cases to a depth of nearly 2,000 feet. The construction of the shafts requires a large amount of timber to prevent caving in and the installation of power plants, operated principally by steam, for raising and lowering the men and material. The system of ventilation in such mines is also very expensive, owing to the distance which air must be conveyed. In many of the principal mining districts methods used are costly and antiquated, compared with the system in this country, a larger number of men and boys being employed, in proportion to the tonnage mined, than in the United States. The writer can state from personal observation that the coal from a few British collieries is still being brought to the surface by hoisting machinery operated by animal power. The size of the cars used upon the railways from the mines to the seaboard, and even of the mine cars themselves, is much smaller in proportion than in the United States, and the locomotives employed have less power; consequently more trains must be made up to transport a certain tonnage, at an increased cost for train crews and other service. The methods of transferring coal from the mines to the cars, and again at the shipping docks, or at the points of consumption, require more manual labor than in this country. As yet, mining by machinery is in its infancy in Great Britain, the majority of the work being done with the pick and hand-drill; consequently the number of miners in proportion to the output is far greater than on this side of the Atlantic.

The methods of procuring soft coal utilize, to a great extent, electricity and compressed air. A power station is built at a suitable point, to generate the electric current for operating the mining machines proper, driving the ventilating fans, furnishing current for the trolley mine locomotives, and supplying light in the various galleries and rooms. As fast as a mine is opened, tracks for the cars are laid in connection with the trolley system, and incandescent lamps placed in the "chambers," thus avoiding the danger of fire by other means of illumination. Many of the companies build houses for their employes, supplying them with light, baths, and other conveniences from the power station, and installing a system of waterworks and sewerage. Usually the power house and dwellings are constructed before mining proper begins. Then the main tunnel or entry is excavated to the face of the coal, its size and direction already being located by the company's engineers. The tunnel is large enough for a double-track railway and terminates in another tunnel or gallery, which extends parallel with the face of the coal seam. From it are cut short passages which terminate in the mining "chambers" or "rooms." These passages are, of course, cut through the coal and are what are termed "double entries," consisting of two passages separated by a partition of the mineral.

If the mining is done by hand, special drills are used, one miner and helper taking a contract to remove the contents of a room from 20 to 25 feet in width and about 20 feet in length.

In machine mining two miners will take a contract to clear out three chambers. The machines, operated by pneumatic or electric power, are carried to the face of the vein, and the framework is fastened in position by being screwed against the roof and sides. The electric current is conveyed to the motor operating each electric machine through an insulated cable which is connected with the main power station. This cable works upon a reel, and can be lengthened or shortened as required. If compressed air is used, it is conveyed in the same manner through flexible piping. The principal mining machines consist of steel punchers or bits bolted to movable metal belts or chains working upon platforms which are also movable. When the compressed air or electric current is turned on, it revolves the chain and its cutters, and at the same time holds the platform supporting the chain firmly against the vein of the coal. A horizontal groove is made of a depth and width varying according to the size of the machine. A Jeffrey cutter will make an incision 6 feet in depth and 4 feet in length within five minutes in ordinary soft coal. The groove is made as near the bottom of the room as possible, in order to cut or undermine the vein at its lowest point.

In one day what is known as a punch machine will cut from 175 to 225 square feet. An electric machine will cut from 720 to 900 square feet. As the average miner and helper, working by hand, will take out with drill and pick but 4 or 5 tons in the same time, the saving effected by the machines in time and labor can be appreciated. It is estimated that the saving to a mining company ranges from 20 to 50 cents per ton, according to the district where the mine is located.

From the time the mine cars are loaded until the coal is in the vessel's hold, a variety of labor-saving appliances is used. The cars, which are run to the entrance of each room, are made up into trains or "trips" which carry as high as 200 tons. One locomotive will do the work of from 15 to 40 horses or mules, according to the power of the motor. It hauls the cars from the entrance of the mine to the tipple, if there is no incline by which the force of gravity can be used. To handle a train of 20 or 30 cars, only a motorman and a brakeman are required. The locomotives vary in power, being built to work on grades as steep as 4 per cent. As they range in weight from 10 to 20 tons, the rails required for the tram road are very light.

At the tipple the weighing, separating and loading of the cars or boats are done automatically. The tipple, which is merely a wooden trestle containing a movable platform and scales, is usually located directly above the railroad track, or at such an incline that the coal will fall into the cars by the force of gravity. A car is elevated at the tipple so that by opening one end the contents run out upon the separation screens and scales, which record the total tonnage. From the scales the coal according to its size falls into the cars, which are usually made up in trains. As fast as a car is filled the locomotive pulls the next empty car below the tipple, and thus the operation is continued until the train is loaded. If it is desired to separate the coal into the three commercial sizes, three tracks are laid below the tipple, and three trains can be loaded at once. In connection with a number of the mines in West Virginia and in the George's Creek and Cumberland region of Maryland, as well as in Alabama, are coke-oven plants, so constructed that the mine cars can be run from the entrance directly over the ovens, and their contents dumped through openings made especially for the purpose, without the necessity of any manual labor except to guide the cars.

The cost of coal mining by the modern process has been reduced to such a figure that the product has been sold at the tipple as low as 90 cents per ton, at a small profit to the coal company. The actual cost of the coal placed on the cars ready for shipment has been reduced as low as 75 cents per ton in the districts referred to. Of course, these figures are subject to slight fluctuations, but it is calculated that 90 cents per ton is the maximum cost of this production. Including the railroad and steamship tariff and the cost of transferring at the destination, American coal has been placed in French ports, for example, at $5.50 per ton at a profit to the shipper. But it is believed that steamships can be built especially for the coal trade which can carry a cargo to Mediterranean ports at less than $1 per ton freight, including wages, food for the crew, fuel and charges of every kind. This figure would enable coal of a superior quality to be sold abroad at less than $3 per ton, fully $2 less than the best Welsh product.

Electrical Notes.

It is stated that the Jungfrau Railway in its entirety is to be abandoned, but the section already built and under construction will undoubtedly be very popular.

All the Russian warships on the Chinese station are to be fitted with Popoff's system of wireless telegraphy. The experiments with this apparatus have been carried out up to distances of forty miles with perfect success.

The premises at 5 West Twenty-second Street, New York city, which were formerly occupied by Prof. S. F. B. Morse, were torn down for the erection of a business building. It is gratifying to note that Mr. McCutcheon has had the tablet which used to mark the house replaced. The addition to the original bronze reads, "This tablet removed from building formerly on this site and replaced A. D. 1900."

A suburban electric street car line in St. Louis has fitted one of its cars with a telephone, says The Railway Review. The instrument is placed in the rear of the car, the negative wire being connected permanently through the wheels to the rail, and the positive wire being fitted with a simple device resembling a jointed fishing pole by which connection is secured to a private overhead wire paralleling the trolley.

The second branch of the Metropolitan Underground Road at Paris was opened on September 29. It runs from the Triumphal Arch to the Trocadero. Another line running north and south will be opened next spring. The American engineers have been impressed with the rapidity with which the work is carried on, only sixteen months having elapsed in building the tunnel from Vincennes to the Bois de Boulogne.

Ever since telephonic communication has been established between London and Paris, it has been constantly rumored that attempts were being made by the English and Belgian governments to inaugurate a similar service between London and Brussels. It is announced that in February, Brussels will be connected with the English capital by the telephone. There have been several obstacles in the way which have prevented realization of this scheme. Great difficulty was encountered in obtaining the sanction of the two governments, but after prolonged negotiations the necessary permission was obtained. The electricians of the English Post Office had two alternative schemes. One was to lay a cable from the English to the Belgian coast; and the other was to utilize the Anglo-French wire as far as Calais, and then to extend to Brussels over wires on land. According to present arrangements it appears that the latter plan is to be adopted, since it has been found impossible with existing instruments to transmit vocal communication through a submarine cable over a greater distance than twenty miles. This is the length of the cable in connection with the London to Paris telephone, and also the cable connecting England with Ireland.

Large refuse destructor and electricity generating works are to be constructed by the vestry of Hackney, a northeastern suburb of London. Five acres of land have been acquired on the banks of the River Lea upon which to erect the buildings. The present designs are sufficient to accommodate 6,000 horse power in boilers, engines, dynamos and switchgear, but the first installation of machinery will only amount to 3,000 horse power which will be sufficient with accumulators to provide a current for 50,000 eight-candle power lamps. The engines will be of the triple-expansion type, with a working pressure of 175 pounds per square inch. Two dynamos will be driven direct by each engine, and a common condenser and cooling apparatus will be supplied to each pair of engines. The refuse destructor will comprise twelve furnaces with a daily burning capacity of 150 tons. It is estimated that the total cost of the scheme will amount to $1,250,000, but it is anticipated that the vestry authorities will effect an economy of $20,000 per annum. According to the Act of Parliament, the vestry are enabled to levy a maximum tariff of 16 cents per unit, but they propose to encourage the more general utilization of electricity by charging 8 cents to private consumers; 6 cents for public lighting; and 4 cents for the supply of electric power.

Science Notes.

An expedition has been sent to Kingston, Jamaica, by Harvard Observatory to observe the planet Eros in its approaching opposition.

Dr. A. Donaldson Smith, the African explorer, has arrived in this country and will deliver lectures. Mr. Edward Whymper has also reached the United States, and has given some lectures.

The Pekin Observatory, which for two centuries has been one of the chief glories of Pekin, has been looted, and half the instruments will go to Berlin, and half to Paris. The instruments were erected by the Jesuits.

Prof. Schiaparelli retired on November 1 from the directorship of the observatory at Milan, where he had been at work for the last forty years. He has been one of the most conspicuous figures in Italian science. His successor is Prof. Celoria.

The Dewey Arch, a temporary structure built to do honor to the victorious admiral on his return, is being removed. For more than a year it has stood in Madison Square without becoming dangerous to passers-by. This speaks well for staff construction.

The four hundredth anniversary of the birth of Benvenuto Cellini will be celebrated in Florence by a festival and by setting up the sculptor's bust on the Porto Vecchio. Invitations have been sent out to goldsmiths' associations all over the world.

A committee of scientific men who were appointed to investigate the matter state that an eruption of Mt. Vesuvius may be expected at any time. It has been some time since there has been a dangerous outbreak. The experts in the observatory say that an eruption may occur at almost any time, but they are not ready to predict the strength of the eruption.

More time, endeavor and money have undoubtedly been put into the Zeppelin airship than into any previous enterprise of this nature. It is thirty years since Count Zeppelin first turned his attention to the airship as an engine of war, and those who were making experiments in flight by means of aeroplanes were inclined to look upon him as a visionary.

The Tiber at Rome has become swollen by heavy rains, and the water in the Forum was six feet deep on December 2. The Protestant cemetery is inundated, and it is impossible to get within 2,000 feet of St. Paul's Without the Walls. A large landslide occurred on the bank, and the arches of two bridges have disappeared. The dwellers in the lower sections of the city are in great distress.

In excavating for the drainage system which is being installed in the city of Mexico, a number of articles were found which belonged to a period previous to the invasion of Cortez. Some of the articles found were golden ornaments with which the Aztec gods were decorated. On the extension of the Mexican Central Railway, workmen dug out $50,000 in gold and silver coins, the government and the workmen sharing equally under the old law of treasure trove.

The new lecture hall of the American Museum of Natural History is believed to be the largest auditorium ever built for scientific lectures. It seats 1,500 persons. There are three screens, each 25 feet square, two being placed at the back of the stage, and one is movable. The lanterns are in a special room in the center of the gallery. The broad platform is provided with unusual arrangements for scientific experiments. The city has thus far paid $4,472,000 for the institution in the way of buildings, etc., and the trustees have raised more than three million dollars additional.

The authorities of the British Museum have recently secured the exhaustive collection of 20,000 moths from Western China which formed part of the collection of the late Mr. J. H. Leach, and is the finest collection of lepidoptera in the world. The Museum paid $5000 for the right to choose what they desire from the collection, which will be about 12,000 specimens. Mr. Leach had specimens of several moths not to be found in any other collection extant. Sir George Hampson, Bart., who classified the moths of India for the Indian government some years ago, will make the choice and arrange them in the present British Museum collection. The work will occupy about twelve months.

Lieut. Julius Payer, well known for his Arctic explorations, was a great admirerer of Dr. A. Petermann, the German geographer, who has given great attention to Arctic explorations. When Lieut. Payer in 1870 discovered the pyramidal mountain in Greenland, he called it Mt. Petermann, and it was long supposed that this was the highest mountain in Greenland. His last survey gave the height as 12,406 feet, but last year Dr. Nathorst discovered that the real height of the summit was between 8,200 and 9,000 feet above the sea level, so that the mountain can no longer be called the highest in Greenland. The Duke of Abruzzi in his last expedition discovered that King Oscar Land and Petermann Land, as was suspected, did not exist. It is probable that Lieut. Payer saw icebergs, which he took for land, so that in both of these cases the connection of the name of Petermann with the two localities is very unfortunate.

Report of the Secretary of Agriculture.

The annual report of the Secretary of Agriculture is a most interesting document. It is devoted to a brief résumé of the important work carried on by the various Divisions. Important extensions of the Weather Bureau work have been made during the past year. Its efforts have been specially directed to the investigation of methods of electrical communication without wires, with a view to establishing wireless electrical communication between vessels at sea and exposed points on our lake and sea coasts. Already messages have been successfully transmitted and received over sixty miles of land, and the Secretary expresses the hope that in the near future the craft employed in our coastwise commerce and on the Great Lakes will be placed in instantaneous communication with the stations of the Weather Bureau located at the principal ports. Special storm forecasts for the North Atlantic will be undertaken shortly through the use of reports received from the West Indies, Bahamas, Bermudas, the Azores, and Portugal, the new cable system connecting Lisbon with America, via the Azores, making this possible. Much stress is laid upon the continued improvement of the forecast service, and the value of its warnings. Mr. Wilson points out that notwithstanding the great number of craft plying the Gulf of Mexico at the time of the Galveston storm, the warnings were so timely that there was no disaster upon the open waters.

The Bureau of Animal Industry has carried on its highly important work, and the total number of cattle inspected before killing aggregated 53,087,994, in addition to an inspection of 34,737,613 animals which had been killed. The total number of carcasses condemned was 61,906, and the number of live animals rejected was about 160,000; 999,554 microscopic examinations of pork were made. During the season of 1899, over a million cattle were moved, under the supervision of the Bureau, from the districts infected with the southern cattle tick. Over 1,800,000 sheep were inspected, and nearly 627,000 dipped under the supervision of the inspectors. The work of preparing serum for various diseases has also been carried on. With regard to rabies the Secretary declares that this disease is unfortunately on the increase in the United States.

The Division of Chemistry has carried on important work in the investigation of food adulteration; over 500 samples of preserved meats of all kinds were purchased in the open market, and examined. The Division finds that very little horse meat is sold in the United States. The foreign food products introduced into this country have been the subject of careful study.

Most satisfactory reports are received from California as a result of the entomological work in the introduction of the insect which fertilizes the Smyrna fig. In one locality more than six tons of Smyrna figs have been produced; this result will tend to make America a great competitor in the fig trade of the world's markets. An important parasite has been introduced to prey upon the olive scale, so injurious to the olive growers of California. From Natal a fungus disease has been introduced by which the injurious worms and locusts have been destroyed, and efforts are being made to introduce European parasites of the gypsy moth.

The results of seed testing are declared to be satisfactory, and to have greatly improved the quality of seed distributed by Congress. Experts of the Division have been studying plants poisonous to stock in Montana, and valuable experiments will be conducted on the ground set aside for the use of the Department on the Potomac flats at Washington. The section of seed and Plant Introduction receives a special notice, stress being laid particularly upon the importation of cereals, including macaroni wheats of southern Europe and grasses and forage plants. The Kiushu rice introduced from Japan has already added one million bushels annually to the Louisiana rice crop. The introduction of date trees into Arizona is another valuable achievement. The introduction of wheats from Russia, Hungary, and Austria is being watched with great interest, and if the wheat yield of the United States should be increased by only one bushel per acre, this would mean at the farm price of wheat in 1899 an addition of $26,000,000 to the income of our farmers. The Division of Vegetable Physiology and Pathology has also been carrying on important investigations. In plant breeding, orange hybrids have been placed at various points in the South and their value has been tested in cooperation with several experiment stations. In corn breeding the features aimed at are early maturity, drought and smut resistance, increased protein content and a large yield. Diseases of sugar beet have been investigated, also diseases of forest trees.

The Division of Pomology made a most interesting exhibit at the Paris Exposition, which attracted wide attention. A special effort has been made to give a thorough test to the cultivation of choice European grapes in the South Atlantic States. The work of the Division of Agrostology has been thoroughly systematized. The grass garden on the Department grounds contains nearly 500 varieties. The destruction of prairie dogs has become a practical question of interest to farmers, and is being investigated by the Biological Survey. Warning is given of the possible danger of the introduction and dissemination of the Belgian hare. Laboratory work and the study of food of birds of economic importance have received attention. The work of the Soil Survey has been greatly increased, but still falls short of meeting the demand for soil surveying from all sections of the country. The work of this division with tobacco is specially noticeable. The tobacco exhibit at the Paris Exposition was one of the largest as well as one of the most complete made, containing over 2,000 samples. Florida-grown Sumatra tobacco was awarded twenty points of merit against eighteen points for real Sumatra leaf, and the yellow tobacco of North Carolina was awarded as many points as the Turkish tobacco with which it competed.

The relations of the Division of Forestry with practical lumbermen and tree planters have been closer and more useful than ever before. The total requests for working plans for scientific forestry exceeded fifty million acres. The Department is receiving with increased frequency applications for planting and working plans for watersheds from which cities obtain their supplies. There is much inquiry in all sections of the United States regarding better roads and better methods of building them. Much work has been done by the Office of Road Inquiry and in co-operating with colleges and stations.

The Secretary reviews at considerable length the work of the experiment stations first established in this country twenty-five years ago. The stations now employ nearly 700 persons, and in 1899 their publications aggregated 445 reports and bulletins. The study of foreign markets abroad with special reference to extending the trade therein for the agricultural products of the United States has been prosecuted with zeal and intelligence. The agricultural exports of the United States for the past fiscal year amounted to $844,000,000. The rapid growth of our export trade to the Orient in recent years is most striking. In 1900 our export trade to the Orient amounted to $107,000,000. The Division of Statistics and the Division of Publications both carried on their labors with the usual satisfactory results. The annual output of publications was 7,000,000. Notwithstanding the enormous amount of work which the Department carries on, the appropriations for the fiscal year amounted to only $3,006,022. In addition, the sum of $720,000 was provided for division among the agricultural stations at the Paris Exposition; American exhibitors in agriculture, horticulture, and food products received about 500 awards.

A New Metal-Etching Process.

A new process of etching metal by an acid blast has been introduced. An atomized spray of acid is projected vertically against the metal surface which is to be etched by means of an air blast, the pressure being from 5 to 8 pounds. The compressed air passes from the air tank to the atomizer and to the washing apparatus. Each atomizer consists of a central tube supplied with air under pressure, and surrounded by smaller tubes in connection with the acid in the tank. By this arrangement the air blast produces a finely divided spray of acid, which is projected with considerable force against the metal surface required to be etched. The surplus acid falls back to the lower part of the tank and is again drawn into the atomizer, so that the liquid is constantly circulated during the progress of the operation. Means are provided for moving the plate during the etching operation, to intensify the action of the acid. After the etching is concluded, the plate is washed with the aid of water under pressure. According to Feilden's Magazine, erosion under the acid blast is very rapid. Some zinc plates treated with nitric acid diluted to 10 degrees Baume were etched in three minutes as deeply as the "second etch" of the immersion process, which will probably occupy about twenty minutes. It is not practical to force the speed of erosion in the ordinary process, as details would be eaten away by undercutting, and the heat would tend to melt the resist. In the case of the acid-blast process the projection of the spray upon the surface in a perpendicular direction insures proper etching without undercutting the protected parts of the metal. Overheating is also successfully avoided, as the compressed air is thoroughly cooled before it enters the aspirators, and the amount absorbed during expansion is fully equal to that due to chemical action between the acid and the metal.

An Invention Probably Lost.

John G. Carter, the inventor of the process of making a substitute for rubber from cotton-seed oil, died recently at Savannah, Ga. The process was known only to Mr. Carter, and unless it is found that he left instructions and directions for the continuance of the work, it is probable that the secret died with him. This is a valuable illustration of the wisdom of patenting all inventions of any commercial value, and not leaving the matter a secret. Very valuable inventions have been lost to the world, owing to a mistaken belief that our patent laws do not give adequate protection.

ELECTRIC FREIGHT CONVEYERS FOR LOADING AND UNLOADING VESSELS.

Up to within the last four years every pound of freight which was sent abroad was handled by means of slings or staging from the wharf immediately alongside of the vessel. Not only is this process necessarily slow—not many sling loads can be handled per hour, even under the most favorable conditions of weather and tide—but it is very expensive, requiring as it does a large number of men to load a ship with reasonable quickness. Moreover, in the slinging of cargo, so many packages are broken that the loss of goods is not inconsiderable.

But during the last four years the method of stowing cargoes has been greatly improved by the invention and perfection of a portable electric ship and warehouse conveyer, an apparatus which requires neither staging nor the hoisting of sack or package cargo. So rapidly does this new invention work, that a ship can now be loaded in about half the time required under the old system, with the same or less number of men employed. The system is at present widely used on Puget Sound. The stowing of 1,000 sacks of grain or flour per hour or 600 tons per day of ten hours is considered an exceptionally good day's work in hoisting or slinging, or by staging; but the same number of men with a conveyer will handle 2,000 or 2,200 sacks per hour. Indeed, it may be stated that the conveying capacity of the machine is governed only by a ship's facilities for receiving cargo.

In large modern ships or in tramp steamers, where the crew in the hold can be increased many-fold, sack and package cargo may be handled at a rate of from 3,500 to 4,000 packages per hour.

Especially serviceable is this invention in the loading of flour, grain, and other perishable cargoes in wet weather. For, since no hoisting gear is needed, tarpaulin or canvas covering can be placed over the hatches, and stretched from the ship's rail to the warehouse door before the hatches are removed and the conveyer placed in position, thus insuring absolute protection to the cargo on the conveyer or in the hold.

All freight which can be handled in slings can be transferred by this conveyer. The saving in claims for damaged cargo has often been noticed at the offices of the underwriters.

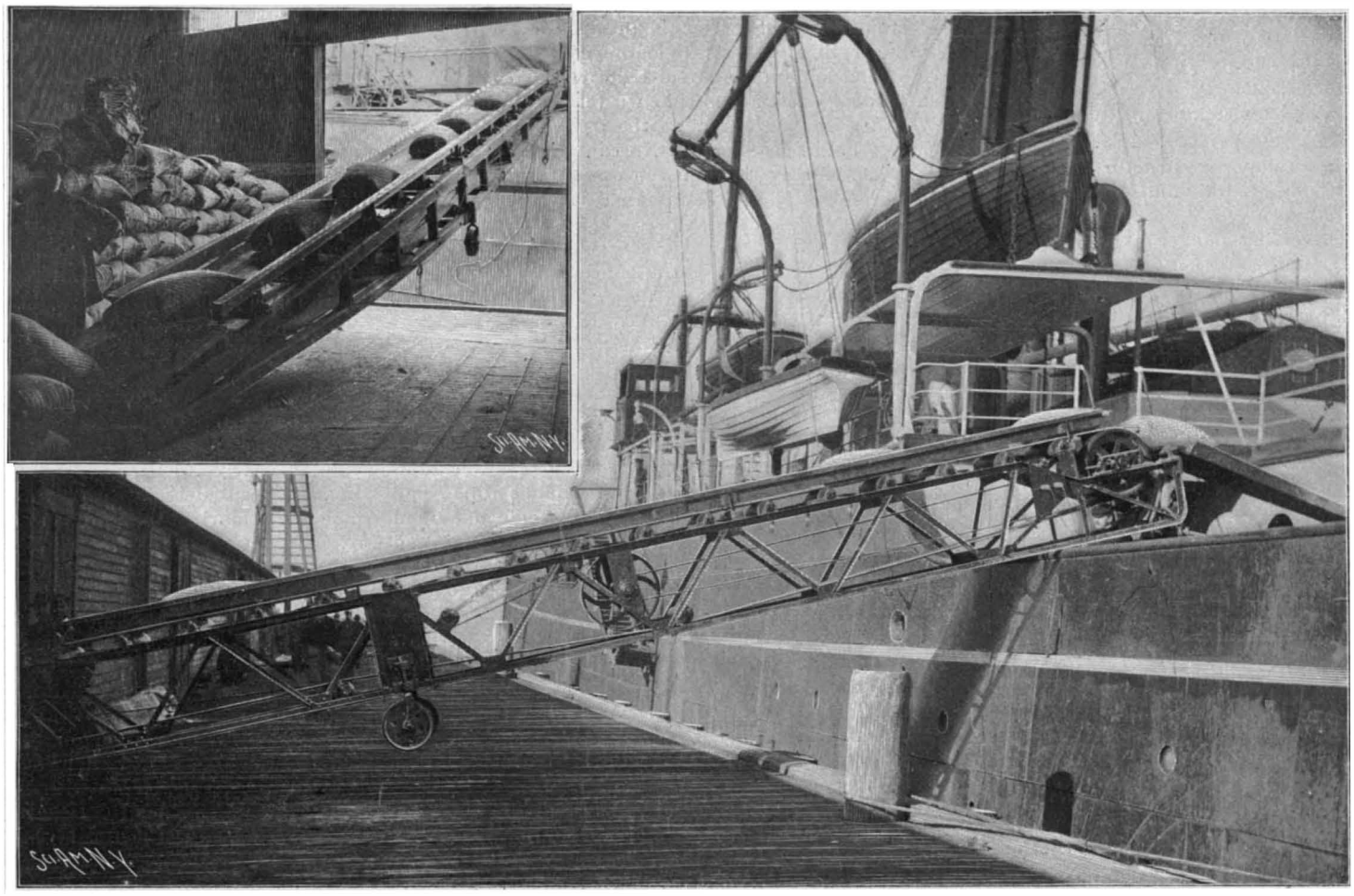
The machine is the invention of Captain W. L. McCabe, of the stevedoring firm of McCabe and Hamilton, Tacoma and Seattle, Wash. In the longitudinal central space formed by a strong iron or steel double truss, from 45 to 60 feet long, according to local requirements of docks or warehouses, an endless rubber or canvas belt or apron 24 inches wide is mounted, to which belt cleats may be riveted. The belt picks up the packages on the wharf or warehouse floor, and deposits them at the ship's rail. The maximum inclination of the conveyer is about 50 degrees.

The belt is driven by an electric motor on the frame of the machine, the motor being so placed that it will be entirely cleared by the belt or working parts of the conveyer, thus insuring safety in operating.

The conveyer is mounted on a pair of swivel ball-bearing wheels in the center, whereby it can be easily and rapidly moved to or from any part of a dock or warehouse. Only three men are required to shift it to and fro.

Since the machine carries its own driving mechanism, it follows that the rise and fall of the tide or the wash of passing steamers cannot hinder the rapid loading or unloading of a cargo.

The conveyer weighs about 2,500 pounds per 45 feet.



THE McCABE ELECTRIC CONVEYER.

THE NEW 12-INCH NAVAL GUN.

The new 40-caliber, 12-inch gun, the first lot of which will be mounted on the new monitors and on the "Maine" class of battleships, and which will henceforth be the standard weapon of this caliber for our navy, has been completed and tested at the Naval Proving Grounds, Indian Head; about twenty rounds having thus far been fired.

By the courtesy of Rear-Admiral O'Neil, we present an illustration of this gun engraved from a photograph taken at the Proving Grounds, which shows both the gun and its mount complete.

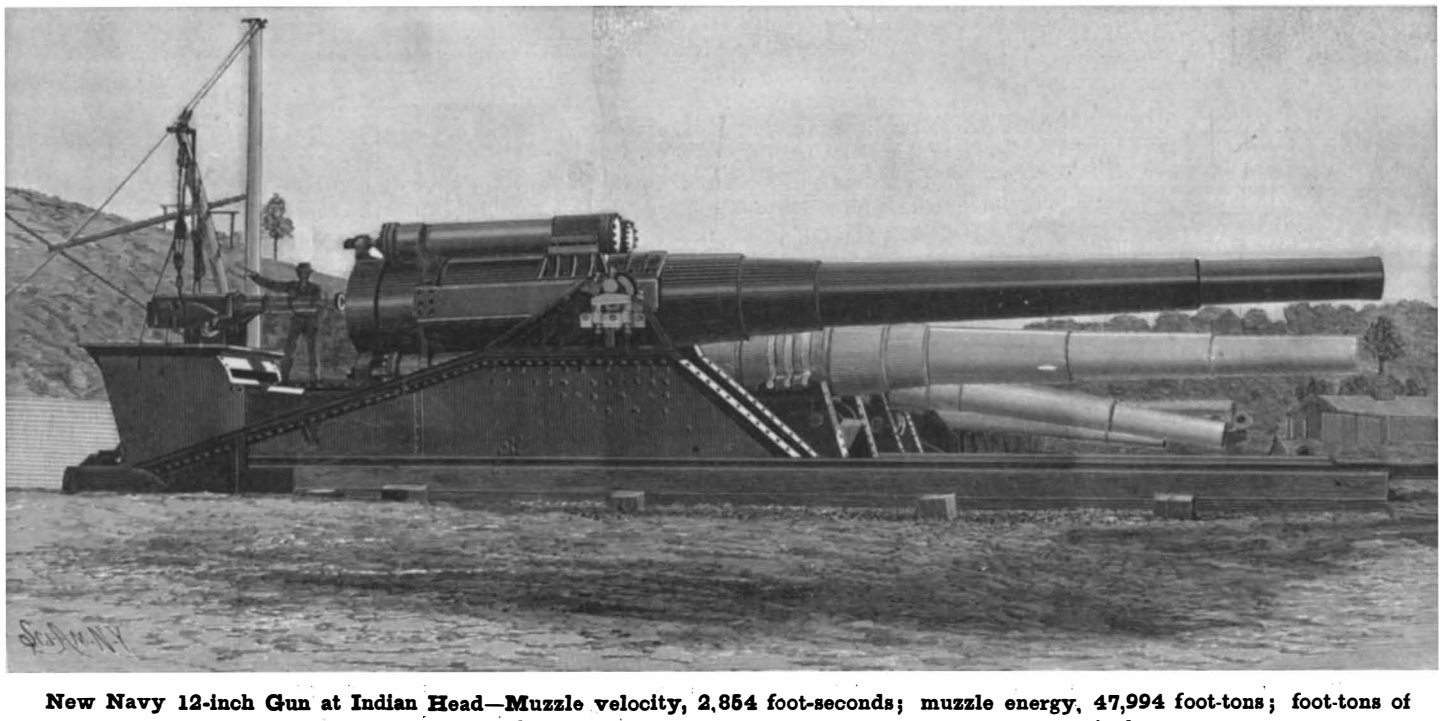
With a charge of 360 pounds of smokeless powder, and a projectile weighing 850 pounds, a muzzle velocity of 2,854 foot-seconds was obtained with a corresponding muzzle energy of 47,994 foot-tons, the chamber pressure being 16½ tons per square inch, or a half ton less than the designed working pressure of 17 tons. We are informed that the gun, its mechanism, and mount, functioned admirably in every respect. The Bureau of Ordnance is to be congratulated in having achieved such admirable results.

The fact that this gun shows 54 foot-seconds greater velocity than it was designed for, with half a ton to the square inch less pressure in the powder chamber, speaks volumes for the excellence of the multiperforated, all-guncotton smokeless powder which has been adopted by the navy; for unlike the high nitro-glycerine powders, such as cordite, which are used by some other nations, our new navy powder achieves these splendid results without any perceptible deterioration of the inner surface of the gun.

It is interesting to compare the new weapon with the 12-inch 35-caliber guns now in service. The new gun weighs 53·7 tons and has a muzzle energy of 893 foot-tons per ton of gun. The present 12-inch gun, which weighs 45·2 tons, has a muzzle velocity with smokeless powder of 2,300 foot-seconds, and the corresponding muzzle energy of 31,170 foot-tons amounts to only 689 foot-tons per ton weight of the gun. From the above comparison it will be seen that the muzzle energy of the new 12-inch gun exceeds that of the old by 53 per cent.

If the energy developed by one round of the new gun could be applied as a constant upward thrust beneath a 12,000-ton battleship, it would be sufficient to raise it 4 feet from the ground.

The excellence of this weapon is shown by a comparison with other 40-caliber, 12-inch guns, which are being constructed by the leading gun-makers of the world. At the bottom of the list is the French gun, which, in spite of its high velocity, shows a muzzle energy of only 30,750 foot-tons, the relatively small energy being due to the very light shell, which weighs only 644 pounds. The inferiority of this gun is greater than appears on the surface figures; for the lightness of the shell will cause the velocity of the projectile to fall away far more rapidly than that of the heavier projectiles. We should note in this connection that although the muzzle velocity of the Krupp 40 caliber gun is lower than that of the new United States gun, because of the greater weight of its shell, it will approach it in respect of its remaining energies at the



New Navy 12-inch Gun at Indian Head—Muzzle velocity, 2,854 foot-seconds; muzzle energy, 47,994 foot-tons; foot-tons of energy per ton of gun, 893; powder pressure, 16·5 tons per square inch.

THE MOST POWERFUL 12-INCH, 40-CALIBER GUN IN EXISTENCE.

longer ranges. Judged by the muzzle velocity and muzzle energy, the new United States weapon stands easily first; but judged by the standard of energy per ton weight of the gun, it will be seen that the Krupp weapon has a considerable lead. It would be interesting, in this connection, to note how Krupp obtains these results with a gun so comparatively light in weight. It is possible that this gun is constructed of nickel-steel, and that an abnormally high chamber pressure is allowed.

COMPARISON OF 12-INCH, 40-CALIBER NAVAL GUNS.

	Weight in tons of gun.	Weight in pounds of projectile.	Muzzle velocity feet per second.	Muzzle energy in foot-tons.	Foot-tons energy per ton of gun.
United States, Naval	53·7	850	2,854	47,994	893
German, Krupp	48·9	981	2,592	45,662	934
British, Vickers	50·3	850	2,600	39,848	792
British, Armstrong	50·8	850	2,580	39,233	772
British, Naval	50·0	850	2,481	36,290	726
French, Naval	45·9	644	2,625	30,750	670
12-INCH GUNS OF 35 AND 50-CALIBER.					
*United States Naval, 35-caliber	45·2	850	2,300	31,170	689
Krupp, 50-caliber	62·4	981	2,953	58,205	934
Krupp, 50-caliber	62·4	771	3,330	58,205	934

* Old pattern as used on "Iowa."

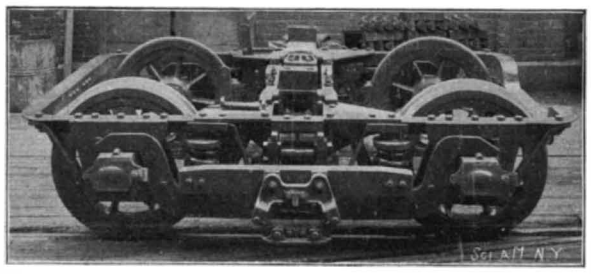
Following the table of the 40-caliber guns are placed three guns of 35 and 50 calibers, the first being the type of 12-inch gun at present in use in our navy, and the 50-caliber guns being two of the 1899 Krupp models, which the company state have actually been manufactured and tested with the results herewith shown. The enormous energy of 58,205 foot-tons is obtained in the first of these two weapons with a 981-pound projectile having a muzzle velocity of 2,953 foot-seconds, and in the second by a 771-pound projectile driven at 3,330 foot-seconds velocity, the energy of 934 foot-tons per ton weight of gun being, as far as we know, the greatest efficiency yet obtained with any gun, experimental or otherwise. As this gun is over 50 feet long, however, it is altogether too unwieldy for service on shipboard, at least according to the present accepted ideas on the subject.

THE THIRD-RAIL EQUIPMENT OF THE MANHATTAN ELEVATED RAILWAYS.

Experimental runs are still in progress with the new six-car motor train which has recently been completed for the Manhattan Elevated Railroads, and the results are so satisfactory that the traveling public may look for a vast improvement in the speed and frequency of the train service on this great system. The experimental train is made up of four standard 18-ton cars and two 35-ton motor cars, one at each end. The motor cars, as far as passenger equipment is concerned, are duplicates of the ordinary cars, but the front end of each consists of a roomy cab with glass on the front and sides, and doors opening into the cab from the side and from the aisle of the car. One of our illustrations is taken from the front of the cab, another shows the motor car and train, and a third represents one of the motor trucks and shows the sliding shoe by which the current is received from the third-rail. This rail is carried outside the tracks, and is safeguarded by two deep longitudinal guard-rails.

The two motor cars, each of which weighs 35 tons, are strengthened beneath the floors by longitudinal plate steel sills, which, it is claimed, will prevent telescoping in case of end-on collisions. Each motor car is equipped with four 150 horse power General Electric motors, one on each axle of the trucks. The eight motors are operated in parallel, the current being controlled by an equalizing switch in the cab, which performs the same function as the equalizing bus-bars in an electric power house. The placing of the power at the ends of the train has the advantage of providing a more even motion in starting, the combined pull at the front and push from behind getting rid of the uncomfortable jerking effects which are at present noticeable on elevated trains. Current is taken from the third-rail by means of the shoe of the front motor truck, and, after passing through the motors in the forward car, is carried by insulated wires to the motors of the rear car. The third-rail is of very heavy section, 100 pounds to the yard, and it was rolled with a special view to its electric conductivity.

The train is fitted throughout with the air brake,



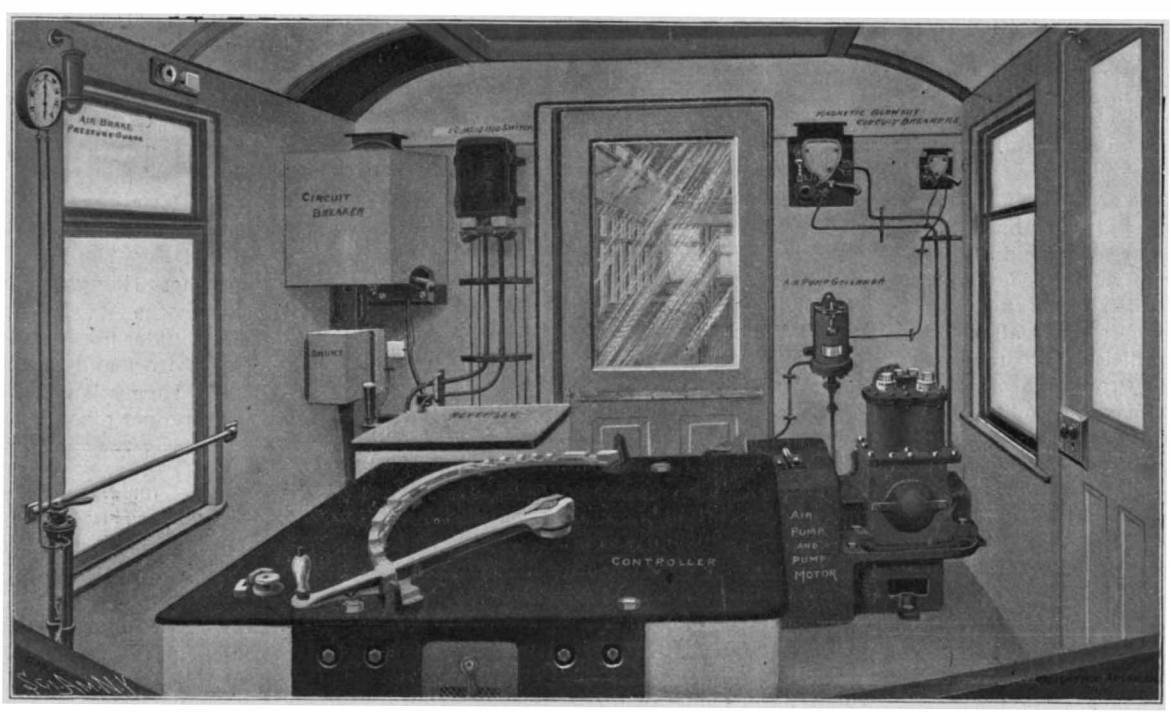
A Motor Truck, Showing Third-Rail Contact Shoe.

which, when the whole road is equipped, will replace the vacuum brakes now in use on the elevated trains. The air brake is of the standard type used on trunk roads, with the difference that the compressors are operated by an electric motor which is automatically controlled by the air pressure. The electric pump and air pump governor are clearly shown in our drawing of the cab. The governor consists of an air cylinder and piston with a vertical stroke, which is so arranged that when the pressure rises to the working pressure of 90 pounds to the square inch, the piston is driven upward against the pressure of a helical spring, and opens a switch controlling the pump motor. As the pressure falls, the springs drive the piston down, and a suitable connection closes the switch and starts the pump. Above the air pump on the rear wall of the cab are the circuit breakers, the one to the left controlling the heat and light of the cars, and the small one to the right controlling the air pump motor. The main circuit breaker is located on the opposite side of the cab, and adjoining it is the equalizing switch already referred to. Below these is the reverser for use in an emergency stop. By throwing over the lever, the current is reversed, and the whole force of the motors is employed to check the train. The controller is located immediately below the front windows of the cab. The air brakes are sufficiently powerful to stop the train, when it is running at the rate of 35 miles an hour, within three or four car-lengths. The reverser and the powerful air brakes combined render the possibility of a collision very remote.

The highest speed of trains will be 35 miles an hour. The average speed, including stops, will, of course, vary with the conditions, being lower where the stations are frequent and the traffic heavy, and higher when traffic is light or the stations more widely separated. How great the acceleration will be is best shown by the authorized statement of the company that the present running time of forty-nine minutes between the Battery and One Hundred and Fifteenth Street on the Sixth Avenue line will be reduced to about forty minutes.

For the present, power is being furnished from the Sixty-sixth Street station of the Third Avenue Railroad, a 500-volt current being used at the motors. A large power house is being erected at Seventy-seventh Street for the service of the whole system, which will have a maximum capacity under overload of fully 100,000 horse power. It is estimated that 400 motor cars will be required for the equipment of the whole system; and as the trusses of the elevated structure have lately been thoroughly overhauled and strengthened, they will be in thoroughly fit condition to stand the heavier loads and higher speeds of the new service.

The New Motor-Car and Train.



Interior of Motor-Car Cab.

THIRD-RAIL EQUIPMENT OF MANHATTAN ELEVATED RAILWAYS.

Telegraphing and Telephoning Simultaneously.

The Rysselberge system of telegraphing and telephoning simultaneously over a single wire is meeting with considerable success in Germany, the Berlin fire brigade being equipped with it.

There are fifteen brigade stations in Berlin, each of which is served by a special network of fire alarms. From these stations underground wires radiate in all directions, each wire being connected with a great number of alarm pillars. The alarms are arranged for automatic working, and to each is fitted a key for telegraphing to the station. As it is, however, a very great advantage to be able to maintain during the progress of the fire a good connection between the alarm pillars nearest the fire and the brigade station, exhaustive trials have been made with a specially adapted telephone which have resulted in the general introduction of the same. To the Morse apparatus at the station a stand is attached, from which a microtelephone fitted with a battery switch and a second receiver are suspended. The remaining apparatus is inclosed in a flat box and placed under the table. This box contains an induction coil, a condenser, and a circuit key. As it would be expensive to equip each of the fire-alarm posts with telephone apparatus, a portable set is used, which may be attached to the posts by means of a plug and socket provided for the purpose. Such a portable set is carried by each of the brigade carts, there being some eighty now in use. The brigades' cycles are also equipped with sets which are very compact in design. Experience with the system has shown that the switching in of the telephone apparatus in no way influences the telegraph service. During simultaneous telegraphing and telephoning a slight knocking is perceptible in the telephone, which, however, does not destroy the audibility.

THE assay authorities at Birmingham, following the example set by London and Manchester, have decided not to stamp any hollow gold articles in future, where the thickness of the gold is less than No. 36 gage. This decision will seriously cripple the cheap trinket and mock jewelry trade, where the keenness of the competition has resulted in the employment of rolled gold of such extreme thinness that the presence of the gold can scarcely be detected.

IV. SIMPLE ELECTRIC MOTOR.

(Continued from last issue.)

BY GEORGE M. HOPKINS.

The next thing to be done is to construct the field magnet, which in this motor is in the form of a ring, as shown in Fig. 1. The core of the field magnet is formed by winding four strips of No. 24 sheet iron ¾ inch wide and 8 feet long upon a wooden core, as in the case of the armature core. The form on which the field magnet is wound being $\frac{3}{16}$ inch larger in diameter than the armature, and as this is variable, it must be ascertained after the armature is wound and balanced, on account of the variation in the winding depending on the covering of the wire and the care with which it is wound. In the motor illustrated, the field magnet ring is 2¾ inches internal diameter and 4½ inches external diameter. Before winding the field magnet core, the ends of the 8-foot strips are scarfed or beveled off and tinned, and then soldered together and coiled for convenience.

The strips should be wound upon the form as tightly as possible, and when the last layer is on, a stout wire is wrapped around the outside and twisted together to keep the sheet iron strip from unwinding, as in the case of the armature core.

As it is not necessary to anneal the field magnet, the wooden form is removed by boring a hole through it and then splitting the wood so that it can be removed piecemeal. The coil of sheet iron forming the field magnet core is composed of thirty-three layers.

The ring is divided into four quarters by radial lines, and midway between two of these lines, on opposite sides of the ring, are drilled holes for rivets $\frac{3}{16}$ inch in diameter, the holes being countersunk slightly on each side. These rivets with slight heads are inserted in the holes, with the heads inside the ring. They are then neatly riveted at the outside, leaving the inner side as smooth as possible. To accomplish this, it is necessary to move the binding wire away from the center of the field magnet ring.

When the two rivets are in place, the binding wire may be removed; then in the same sections near the ends are placed rivets, one at each end of each section. The sections riveted in this manner form inwardly projecting pole pieces. While drilling the holes for the rivets, it is necessary to clamp the strips firmly together to prevent the drill chips from working in between the layers of the magnet. Eleven layers of the magnet ring are sawed out between the pole pieces to make a space for the winding of the field magnet; the ends of the pole pieces are beveled as shown to facilitate winding. These spaces are covered with adhesive tape and are wound with four layers (about 45 feet) of No. 18 magnet wire, either single or double, cotton or silk covered.

One of the pole pieces will be at the bottom of the field magnet and the other at the top when the motor is complete; therefore the winding on each side of the field magnet begins at opposite sides of the same pole piece, and is wound in the same direction to bring the wire terminals near the base of the machine, and to cause the current in the two windings to unite in producing a north pole at the top of the magnet and a south pole at the bottom, or vice versa. If a mistake is made in the winding, this can be corrected in making the connections. It is not necessary to unwind and rewind.

The construction of this magnet is open to criticism on account of the disposition of the laminæ, but this construction is partly or wholly compensated for by the large rivets, which bind the pole pieces and the body of the magnet together.

The holes are drilled in the lower side of the magnet and tapped to receive machine screws, which pass upward through the base of the machine to hold the magnet, which latter sits upon a small wooden saddle about ⅛ inch thick in the middle. The field magnet winding, as well as the iron core, is covered with several coats of shellac varnish, for insulation and protection.

The journal boxes for the shaft are simply ⅝ brass balls axially bored to receive the shaft, and having an oil hole in the top. These boxes are each held in place by two brass plates bored to receive the sides of the balls, as shown, and attached to the sides of the square wooden standards by screws. The shaft is allowed to project at one or both ends sufficiently to receive a pulley or fan. The armature is wrapped around the sides with enough firm paper to cause it to fit tightly into the field magnet, and after the shaft is made level, the journal boxes are placed on the shaft, and the standards which support them are sawed off the proper length and secured to the base by screws, one for each standard, passing upwardly through the base and into the lower ends of the standard. To the base adjoining the standard at the commutator end is attached a wooden block, to the ends of which are secured light copper springs, which bear on opposite sides of the commutator and act as brushes for conveying the current to the armature.

The screws which hold the lower ends of these brushes also clamp the wires which extend downward through the base, one being connected with one of the binding posts which receive the battery wires, the other brush being connected with the outside terminal of one of the field magnet coils. The outside terminal of the other field magnet coil is connected with the remaining binding post. The inside terminals of the field magnet coils are connected together. The connections are clearly shown in the diagram (Fig. 2). The upper screws in the commutator brushes are used for varying the pressure of the brushes on the commutator as may be required; the brushes being bent outwardly to admit of this adjustment.

If the motor is to be used for driving a fan, the base will need to be set upon legs of some kind. In the motor illustrated, the base is supported upon four inverted clothes hooks which support it 2 inches from the table.

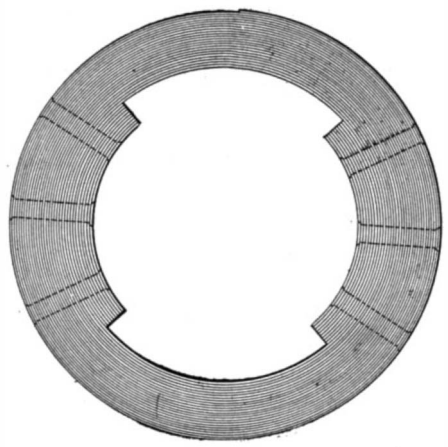


Fig. 1.—FIELD MAGNET CORE.

The oil cups are made of wood (soft maple or birch), with stems extending down into the $\frac{3}{16}$ holes in the spherical boxes; and in the portion of the wood above the journal box is formed a cavity which will contain a few drops of oil. The outside of the oil cup is varnished with shellac except at the end of the stem, before any oil is put in. This confines the oil to the cavity and the interior of the stem and causes it to slowly feed to the journal on which the stem rests. The fan can be purchased for a small sum. It may be necessary to bush it to fit the shaft. Either an 8-inch or a 10-inch fan may be used.

Of course, a small pulley will be substituted for the fan when the motor is used to drive a machine.

If the motor when finished does not run in the desired direction, this may be changed by transposing the wire connections at the brushes, so as to change the direction of the current in the armature.

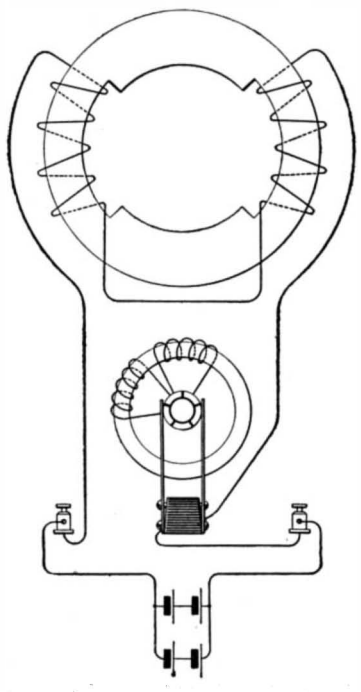


Fig. 2.—ELECTRICAL CONNECTIONS OF MOTOR.

Valuable Greek Antiquities.

Mr. J. Pierpont Morgan has recently presented to the Metropolitan Museum of Art a votive mask, a necklace and victor's wreath and bridal wreath, which were discovered some time ago at Olbia, an ancient colony of Miletia in Scythia. At first it was thought that the gold crown was that of a king, but an inscription on it shows that it was that of a priestess of Demeter. The work is not in repoussé, but appliqué. Upon the back of the necklace is another word which signifies "belonging to Zenoklides." This shows that the necklace and the crown belonged to two different persons, and not to one. The pendants of the glass amphoræ have all been fastened to the necklace, and it is now complete. The bridal wreath is composed of leaves of oak, myrtle and hawthorn made of silver which has become oxidized by long exposure to the earth. Between the leaves are little buds of gold. The specimens are among the most perfect possessed by any museum in the world.

Engineering Notes.

Five million dollars will be expended at Dover, England, for dock extension, with a view of accommodating vessels of the size of the "Oceanic," as several American lines have intimated that they will sail from that port when the work is completed.

The annual report on the changes in rates of wages and hours of labor in Great Britain during the year 1899 has just been issued. The prosperity of the country was such that the percentage of the unemployed was the lowest recorded since 1890. The changes of wages last year aggregated a rise of $575,000 per week, an increase of $100,000 over the year 1898.

The municipal authorities of Bristol are petitioning the British Parliament for the necessary powers to extend and to improve the dock accommodation at Avonmouth. The principal item of the scheme is the construction of a huge ocean dock to accommodate the largest cargo steamers and liners. The total cost of the undertaking is estimated to be $9,020,000.

The British Naval Department has issued applications for tenders for coal, and for the first time they require a twelvemonth's supply under normal conditions, and also for any further supplies that may be rendered necessary though any unforeseen circumstances. This is the largest single order ever placed in the coal trade in England. It is anticipated that it will amount to about 1,000,000 tons.

The first vessel, the "Runic," with which the White Star Line are founding their colonial fleet, has been launched from the yard of Messrs. Harland & Wolff, at Belfast. She is a twin screw steamer, 565 feet in length, 64 feet beam and of 12,400 gross tonnage. When completed, she will be one of the largest passenger steamers afloat, and her inauguration will commence a new era in connection with the colonial ocean traffic with Great Britain.

The Boston & Maine Railway gives cash prizes yearly to station agents for floral displays at their stations, says The Railway Review. Prizes of $50, $40 and $25 were distributed to the station agents at South Lancaster, Waltham and other places. At some of the principal stations on the Kansas City, Fort Scott & Memphis Railway greenhouses are to be established, in which passengers will be invited to pass their time while waiting for trains, and the surplus flowers will be supplied to the dining cars on the through trains.

Extensive dock works are to be undertaken at Manchester, which will considerably improve the commercial prosperity of that city. Some thirteen acres of land have been acquired, and a large new basin with a water frontage of one mile, railway tracks, warehouses, storage grounds, etc., are to be constructed. The object of the scheme is to enable the largest modern steamers to berth easily and comfortably. Probably the success of the Manchester Ship Canal is responsible for these large additions to the dock capacity of Cottonopolis.

The Current Supplement.

In the current SUPPLEMENT will be found many articles of general as well as of scientific interest, for the most part illustrated by clear engravings. "The Building of the Great Wachusett Dam," by J. A. Stewart, is a lucidly written description of a notable engineering undertaking. The inaugural address of Prof. John Perry, president of the Institution of Electrical Engineers, on "Electrical Engineering as a Trade and as a Science," is continued. The clay-working machinery exhibited at Paris is discussed in a well-illustrated article. Prof. MacCord contributes an interesting account of a new elliptical lathe which can perform all that can be done with the appliances hitherto employed, as well as work which could not formerly be executed on elliptical lathes. "Irrigation in the East and West" describes the work of the Department of Agriculture. "An Automobile Mowing-Machine" is a new invention which will probably excite no little interest. The inaugural address of Carl Hering, president of the American Institute of Electrical Engineers, is reproduced; the subject discussed is "The Paris Exposition of 1900." One of the most thoughtful and earnest articles is a paper by George W. Dickie, entitled "Can the American Shipbuilder under Present Conditions Compete with the British and German Shipbuilders?" The usual trade suggestions, notes and recipes will be found in their proper place.

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RECENTLY PATENTED INVENTIONS.

Electrical Apparatus.

ELECTRIC MOTOR.—JOSEPH DARLING, Chicora, Penn. The motor is of that type in which the oscillation of an armature in front of the pole of the electromagnet is converted into rotary motion by means of a connecting-rod and crank-shaft arranged above and at right angles to the longitudinal axis of the electromagnet. The armature has a rocking axis directly at the pole of the magnet. To the other end of the armature an arm is rigidly attached, extending at right angles to a point near the opposite end of the electromagnet. A crank-shaft is arranged at right angles to the electromagnet. A pitman is disposed on the opposite side of the crank-shaft from the armature and connects the armature-arm with the crank shaft.

COMMUTATOR-BRUSH HOLDER. — HARRY BISHOP, Manhattan, New York city. To insure a firm contact of the conducting-block and the commutator and the seat of the block, and to permit a free sliding movement of the conducting-block without danger of the block's leaving its seat, the brush-holder is provided with a follower which serves to press the conductor to its seat. The follower consists of an angular lever, on opposite sides of the fulcrum of which are rollers arranged to engage one end and the outer face of the conductor to hold the latter against its seat and against the commutator, at the same time preventing movement of the conductor from its seat. Arcing is prevented and the life of the brush lengthened.

ELECTRIC FIRE-ALARM.—CHARLES L. HAIGHT, Poughkeepsie, N. Y. In this invention the fusion of metal at a low temperature releases the alarm. The circuit-closer employed comprises spaced contact-plates held in a casing and connected with the circuit-wires of an alarm. A contact-bar is mounted to slide in the casing, the outer end of the bar having a flanged offset. A spring moves the bar into engagement with the contact-plates. A binding-post is secured to the casing. A fusible connection between the two binding-posts normally holds the bar out of contact with the plates.

Engineering Improvements.

ROTARY-CYLINDER STEAM ENGINE.—GEORGE O. SANDERSON, Fertile, Iowa. The invention relates to that class of rotary engines in which the cylinders rotate about a stationary shaft, so as to act as a pulley for transmitting power. A tubular shaft is divided by a partition into admission and exhaust passages opening at opposite ends of the shaft. A steam-chest is fixedly held on the shaft near each end and has channels registering with the ports of the previously-mentioned passages. On the chests are spring-pressed slidable pistons. A cylinder, divided into compartments, is rotatably mounted on the shaft and has inclined abutments adapted to ride over the pistons. A diametrically-arranged cut-off is secured in each head of the cylinder.

Mechanical Devices.

SCRAPER.—GEORGE E. RICHARDSON, Chief, Mich. Mr. Richardson has improved a scraper which he has already patented, so that it can be raised and lowered at either the front or back by means of mechanism operated from the axle. The scraper, in the present invention, is evenly balanced so as to avoid lift on the neck of draft-animals; for the draft will be beneath the tongue. The scraper in no manner interferes with the driver in guiding the team. The drive shaft receives motion from the supporting-wheels of the frame. The drive-shaft is connected with lifting-shafts by a driving connection which serves alternately to operate the lifting-shafts. The scraper has its forward end portion controlled by one of the lifting-shafts, and its rear end portion by the second lifting-shaft. Both shafts act to raise or lower the scraper.

REFINING-ENGINE. — CHARLES E. TORRANCE, Northampton, Mass. The inventor has devised a refining-engine for paper-makers, which engine is arranged to prevent hard substances from coming in contact with and injuring the cutter bars or blades and to permit convenient adjustment of the revolving plug in the shell to compensate for wear of the bolts without, however, shifting or otherwise disturbing the driving-gear for the plug-shaft.

APPARATUS FOR CARDING-WOOL. — HUBERT L. OFFERMANN, Leipsic, Germany. To remove the burs and other foreign substances from the wool, the well-known licker-in cylinder and beater operating against the points of the cylinder-teeth do not work sufficiently well, for the reason that only the burs on the surface are removed. The equally well-known carding process is likewise defective; for the distance between the worker-cylinder and the carding-drum, while great enough to permit the passage of the burs, is too great for the proper carding of the wool. In the present arrangement, notwithstanding this large distance between the drum and workers, the wool is not carded as heretofore from the drum into the worker-cylinders directly, but is removed from the drum and transferred to the workers by means of a special transferring-roller, in order to be then presented to the drum for treatment.

RAG-ENGINE.—EDWARD A. JONES, Pittsfield, Mass. Mr. Jones has invented a new and improved rag-engine in which a doctor is employed to prevent any of the pulp from being carried over by the heating-drum or from being lodged near the doctor under the cover to insure a free and easy running of the drum. The doctor is adjustably mounted to compensate for wear and removable to permit convenient exchange for a new one when worn out.

WHIM.—JOHN H. O'BRIEN, Nasby, S. D. The object of the invention is to provide a new and improved whim or miner's hoist which can be operated with safety and dispatch. In operation the bucket is raised high enough to permit a car to be run under the bucket. The tender then depresses a foot-lever, thereby disengaging the sweep from the drum and at the same time applying the brake hard. By keeping command of the brake the bucket is lowered on to the car, and this done without letting the rope slack, the brake-lever is locked with the brake applied, and the bucket is cast off. With the rope maintained free from slack, the bucket can be swung clear of the car and will hang plumb without the necessity of starting the horse to take up slack, as is the case when the ordinary arrangement is employed.

Railway Appliances.

RAIL-JOINT.—JAMES S. PATTEN, Equitable Building, Baltimore, Md. The novel feature of this invention is to be found in a chair consisting of a clasp-section having a laterally opening seat for the edge of the rail-base. A base-plate is also used, provided near its free edge with an inclined surface adapted to operate by a wedging action upon the edge of the rail. A clamping-section has a base-plate adapted at its outer edge to engage with that of the base of the clasp-section and so formed that it presses upon the base of the rail and forces the rail into the seat of the clasp-section. The construction is both strong and cheap.

Miscellaneous Inventions.

EXTENSION-TABLE.—JOHN T. LA TURNO, Commerce, Mo. The object of the invention is to provide a table arranged to permit its extension by one or more auxiliary leaves which also serve to lock the table in place. The table is constructed with separable sections. Arms, pivoted at the central portion of the table, carry rigid auxiliary leaves. Levers are pivoted at one end on the arms and are designed to impart a swinging motion to the arms to move the auxiliary leaves into position on drawing the sections apart. When swung into position, the auxiliary leaves can be closely joined to the tops of the table sections. A locking-device locks the table-sections in position.

TOY MONEY-BOX.—WILLIAM H. DIETZ, Chicago, Ill. The invention provides an improved savings-bank for the use of children. The bank comprises a glass vessel having a threaded neck upon which a cover screws, having a coin-receiving slot. A pin is provided for insertion in registering apertures in the flange of the cover and neck. A lock engages registering eyes in the pin and the cover to lock the pin against removal from the apertures. The money is at all times visible, but cannot be removed until the cover is unlocked.

DRESSING-CHAIR.—CULLEN A. ROBERTSON, Sparta, Ga. The invention is an improvement in dressing or toilet-chairs, and provides a rest or support for various articles of clothing and embodies a large number of useful features in its construction. The chair includes a clock; a mirror; hangers for clothes; knobs for hats; a shelf for combs and brushes; a socket for a lamp in the shelf; slats for stockings; shoe-rests; a rest for shaving-articles; a shoe-blacking receptacle; and a trousers-press.

ROD OR RIVET CLUTCH. — HARRY ALAMAN, Terre Haute, Ind. This invention is a tool adapted for application to a rod for rotating it for any purpose or to a short screw-threaded rivet for the purpose of screwing it in place. The tool is particularly useful for inserting threaded rivets to secure boiler-plates together.

BOWLING-ALLEY.—HENRY BLOUTH, Grand Union Hotel, Wilmington, Del. Mr. Blouth has devised a means for conveniently resetting the pins which have been knocked down, for indicating to the bowlers the pins which have been knocked down, and for returning to the bowlers the balls which have not been thrown with sufficient force to travel entirely up the incline leading to the ball-returning trough.

CORNER-STAKE.—JOSEPH S. WEBSTER, Minneapolis, Minn. This corner-stake is designed for the use of surveyors and engineers and is adapted to be set in the ground and to contain a record of the surrounding ground and other information and is so arranged that it can be conveniently secured in place, or shifted from place to place.

PHOTOGRAPHIC-PLATE WASHING AND FIXING APPARATUS.—SAMUEL SALOMAN, Bronx, New York city. The apparatus is provided with liquid inlet and outlet pipes closed by caps. In fixing the plates the caps remain on the openings of the pipes. In washing the plates, the caps are removed, so that a continuous circulation of water can be maintained through the apparatus.

SURGICAL APPLIANCE. — THOMAS D. MCKOWN and HARRY E. CLARK, Cripple Creek, Colo. The appliance serves as a rest or support for a leg from the foot to the knee and is so constructed that it is adjustable and can remain without harmful effect upon the limb for any necessary period of time. The appliance so supports the limb that convenient access may be gained thereto at the sides, front, and back, enabling splints or bandages to be readily applied or the limb to be manipulated as required.

WINDOW-SASH.—SALVATOR J. BUZZINI and GIOVANNI FERRACIOLI, Manhattan, New York city. The invention relates to a window-sash of that class in which the sashes are adapted to swing open as well as to slide. The upper sash has a swinging sash-section; and the lower has two swinging sash-sections. A ledge is hingedly mounted on the upper sash and is designed to swing down over the top of the two swinging sash-sections of the lower sash. A fastening device holds the ledge in place.

CURTAIN FIXTURE.—FRANCIS B. JACOBUS, Jersey City, N. J. The curtain-fixture is so constructed that, when applied to the window frame and a curtain is suspended from the bracket, an obstructed space for the free circulation of air is obtained at the upper portion of the window between the curtain-roller and the window-frame. A person is thereby enabled to draw down the curtain and lower the top sash, thus allowing ample ventilation at the upper portion of the room without necessarily admitting much light. The curtain can be held close to the window-frame by means of a guide-roller.

SIZING-KETTLE. — WILLIAM WILSON, Danbury, Conn. The purpose of this invention is to provide a sizing-kettle with means by which the water therein can be kept clear and free from the impurities in the sizing-kettle. This purpose is attained by arranging a strainer in the kettle and forming the vessel into two compartments. The water is forced to circulate upward in one compartment and downward in the other. All the impure matter which floats in the sizing-kettle is thus caused to pass down into the strainer, so that only pure water emerges.

MILK-CAN.—JOHN GERMAN, Aubrey, Wis. Passing longitudinally through the milk-can from top to bottom is a tube which registers with an opening in the cover. A tube projects from the cover-opening and has sliding engagement with the tube of the can. A portion of the cover-tube is perforated and forms a screen; while the other portion of the cover-tube is imperforate, so that according to the position of the cover, the interior of the can is ventilated or not.

FIREPROOF TAR-KETTLE.—ELIJAH CUBBIDGE, Brooklyn, New York city. The kettle is to be used for boiling the tar or asphalt employed in making roads. The object of the invention is to construct the kettle so that tar cannot take fire while boiling. To secure this end, a fireproof connection is provided between the top of the kettle-top and the wall of the furnace, so that flame cannot pass out from the top of the furnace.

VIZOR FOR CAPS.—MAX MATTES, Manhattan, New York city. The vizor consists of a piece of felt stiffened by a sizing and compressed. The sized and compressed felt is saturated with lamp-black and oil and has its top and bottom surfaces coated with layers of enamel. The edges of the felt are left raw. When the vizor is prepared, a jet-black raw edge is exposed which closely resembles the edge of leather.

CUFF-HOLDER. — EPHRAIM C. SHEDD, Wichita, Kans. While substantially rigid longitudinally, the holder can be turned axially and laterally at its portion adjacent to the sleeve-engaging clip, thus facilitating the attaching of the sleeve, especially when there are wrinkles with which it is usually difficult to engage the edges of the ordinary clip.

DEVICE FOR CONTROLLING HORSES. — CHARLES E. WILLIS, Manhattan, New York city. The attachment is always in position for instant use to check a vicious or unruly animal by contracting his windpipe, without, however, injuring him. The horse is thus compelled to release the bit, if held between the teeth, and to check his speed. The attachment can be used either with driving or with saddle horses.

BOTTLING-MACHINE. — CHARLES H. BOGART, Brooklyn, New York city. This machine is especially adapted for bottling milk, either condensed or plain, and is so constructed that the milk is evenly directed to a series of nozzles and the supply regulated before it reaches the nozzles, and that the delivery ends of the nozzles are simultaneously opened or closed, as desired.

DEVICE FOR PREVENTING HORSES FROM CRIBBING.—ALFRED and CARL THOMSON, Fort Ransom, N. D. The device comprises a rotary part arranged above and extending along the front board of the manger. When the horse bites his manger, the rotary part immediately turns, and thus eventually cures the horse of his habit.

KNOCKDOWN BOX. — ERNEST RASCHLÉ, Paris, France. The object of the present invention is the provision of a system of metal mountings or fasteners for use in the manufacture of chests, trunks, boxes, furniture, and other objects which can be entirely assembled or taken apart. The essential feature of the invention is a fastener, comprising two converging legs or end members, both adapted for attachment to the same part of the box. The inner ends of the end members are spaced. A central member extends from the inner end of one end member to the inner end of the other, and is constructed for attachment to another part of the box.

CABINET PICTURE-FRAME.—LOUIS B. PRAHAR, Brooklyn, New York city. The frame is so constructed that the picture, back, and glass will be entirely surrounded by the frame, effectually preventing the parts from accidentally dropping out after having once been placed in position in the frame. The top member of the frame can be removed to provide an opening through which the picture, glass, and back are slid into place.

WINDOW-SCREEN.—ELBRIDGE G. HOLDEN, San Antonio, Tex. The window-screen comprises a netting supported by a thin metallic frame. The sides of the frame form slides for engaging the inner faces of the window-stops. The transverse cross-bars of the frame and the netting are corrugated vertically, the corrugations acting as lateral springs for holding the slides in frictional contact with the stops and permitting the screen to be used on windows of different widths. Closing-pieces are employed for the corrugations.

SASH-HOLDER.—OTTO F. HELFRITZ, Chicago, Ill. The invention relates to a class of sash-locks which engage the sashes and the side of the window-casement to hold the sashes at desired points of vertical adjustment and lock them closed or partially closed. In a casing two locking-arms having convex outer edges are pivoted and held to rock toward and from each other, so that their ends can be projected from the casing. Two keeper-bars are adapted to hold the locking-arms retracted by their engagement with the members of the arms at their rear ends.

CATCH-BASIN OR FRESH-AIR INLET.—WILLIAM H. DEWAR, Manhattan, New York city. The catch-basin or fresh-air inlet has a self-cleaning top or grating and a back-pressure valve, which valve can be removed in a convenient manner whenever desired. The basin or inlet is so constructed that it can be flooded and cleaned at any time through a connection with a convenient water-supply.

BUCKLE.—SAMUEL and ABRAHAM BIENENZUCHT, Manhattan, New York city. Two telescopic members are employed which lock automatically. The locking-device is at the back of the buckle, but operated from the front, and so placed that its operation is not affected by any movement on the part of the wearer. The buckle is applicable to suspenders, garters, and gloves.

CURTAIN-ROLLER. — BENJAMIN F. BELL, Nashville, Tenn. The inventor's construction is designed to prevent one from overwinding or drawing the shade down too far. In the curtain-roller a screw-shaft turns. As the roller rotates, it carries with it a projection. A nut is threaded on the screw-shaft and has a lug arranged for engagement by the projection on the roller, means being provided for holding the nut from turning with the screw. The raising or lowering of the roller adjusts the nut to position in order to engage the projections arranged in the path of the nut to stop the turning of the roller.

BOTTLE-CLOSURE.—JOHN F. PERRY, 408 East 63d Street, Chicago, Ill. The closure comprises a cap, provided on its outer side at or near its upper end with a downwardly-facing stop-shoulder and with tongues, at its lower end, sprung normally outward. A fastening-device is held between the shoulder and the tongues and is slidable longitudinally along the cap, whereby it may be adjusted to press the tongues into engagement with the bottle-neck.

BEDCLOTHES-HOLDER.—CHARLES J. WADE, Pension Office, Washington, D. C. The invention is especially designed for use on children's beds for the purpose of preventing the child from throwing off the cover. The construction is such that the movements of the child are in no way impeded and that the child may even readily assume a sitting posture. But whenever the child lies down, the clothing is instantly returned to the desired position.

Designs.

BELT.—WILLIAM WASSERSTROM, Manhattan, New York city. At the back of the belt is an elongated lozenge-shaped panel. A back section is interlaced through the central portion of the panel, whereby vertical sections of the panel are apparently embossed.

BELT.—JOHN STEMBER, Manhattan, New York city. The belt consists of two sections, united at the back by an ornamental connection, at which connection a portion of one section is passed through the other.

NOTE.—Copies of any of these patents can be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

INJECTORS: Their Theory, Construction and Working. By W. W. F. Pullen. Manchester: Technical Publishing Company, Limited. 1900. 16mo. Pp. 187.

It is seven years since this work was first published. The present edition describes the latest patterns of injectors. The subject is treated in a thoroughly practical manner, and includes not only the practice but the theory of the injector. Air injectors are also included.

SCIENCE OF COLOR MIXING. A Manual Intended for the Use of Dyers, Calico Printers and Color Chemists. By David Paterson, F.C.S. London: Scott Greenwood & Company. New York: D. Van Nostrand & Company. 8vo. Pp. 128. Price $3 net.

The author has produced an excellent book. A new work on this subject has not appeared for a long time, and the progress which has been made in dyeing, etc., has been very great. A valuable feature is the various pattern plates. This new series of technical manuals is a most important one.

HEDGES, WINDBREAKS, SHELTERS AND LIVE FENCES. A Treatise on the Planting, Growth and Management of Hedge Plants for Country and Suburban Homes. By E. P. Powell. New York: Orange Judd Company. 1900. 16mo. Pp. 140. Price 50 cents.

An excellent little book which will meet the needs of many persons. It will be welcomed by all who have country places and by landscape gardeners. It is well gotten up and illustrated.

QUANTITATIVE CHEMICAL ANALYSIS. By Frank Clowes, D.Sc., and J. Bernard Coleman. Philadelphia: P. Blakiston, Sons & Company. 1900. 12mo. Pp. 582. Price $3.50 net.

It has been the custom of authors of most books upon chemical analysis to leave out illustrations of apparatus and methods of doing the work, or at least to use them sparingly. The volume before us is an exception to this rule, but it seems as though even more illustrations could profitably be used, for unfortunately chemical analysis must sometimes be picked up by the amateur without instruction. The volume before us treats the subject in a clear manner and it is one of the best we have ever seen for the use of the beginner and amateur.

FREE-HAND PERSPECTIVE. For Use in Manual Training Schools and Colleges. By Victor T. Wilson. New York: John Wiley & Sons. 1900. 8vo. Pp. 280. Price $2.50.

The value of free-hand drawing, and especially free hand perspective, in all shop work will be conceded at once. The author has produced a most important volume which will prove of value to every one who has occasion to make even the roughest kind of perspective drawings. The section relating to perspective sketches from working drawings is particularly valuable, some of the illustrations being notably good. It is a style of book which should have a large sale.

CHURCHES AND CHAPELS. Their Arrangement, Construction and Equipment. By F. E. Kidder, C.E., Ph.D. Second Edition, revised and enlarged. New York: William T. Comstock. 1900. 8vo, oblong. Pp. 157. 54 plates. Price $3.

The first chapters of this work are found interesting, treating as they do of the constructive features of churches a subject almost entirely neglected by writers upon this topic. The book is elaborately illustrated by diagrams and engravings. The author seems to cover the subject in a thoroughly satisfactory manner. Such topics as acoustics, heating, lighting and ventilation, church bells, tower clocks, etc., are not neglected.

GALVANIZING AND TINNING. A Practical Treatise on Coating with Tin and Zinc. By W. F. Flanders. New York: David Williams Company. 1900. 16mo. Pp 93. Price $2.

Technical literature is very deficient in information upon galvanizing and tinning, and we note with satisfaction the present volume, which gives precisely the information which is always asked for. It is written by a practical man, who has made the installation of galvanizing and tinning plants a specialty. The directions are common sense and the illustrations are excellent. It has a special chapter on tinning gray iron castings.

Business and Personal.

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Minerals sent for examination should be distinctly marked or labeled.

(7996) R. S. A. asks: Which will run the "simple electric motor" the most number of (clock) hours—a battery of 16 volts and 4 amperes, or a battery of the same voltage and 40 amperes? Also, how does an ampere-hour correspond with the clock-hour? A. The battery with 40 amperes of current will last ten times as long as one of 4 amperes, if the current is drawn out of each at the rate of 4 amperes per hour. An hour is the same for clock or battery. An ampere-hour is a current of 1 ampere of electricity flowing for one hour. The idea is just the same as when we speak of water flowing through a 1-inch pipe for an hour; a fixed quantity will flow through in one hour. The quantity of water which can flow through a pipe is controlled both by the size and the length of the pipe; so the amperes are controlled by both the size and length of the wire which carries the current.

(7997) C. C. writes: Could you state about what would be the total cost of the "Simple Steam Engine" shown on page 314 of your issue of November 17? How much ower has it? I am interested in this little machine and would be pleased if you could furnish me with the information. A. This simple engine to which you refer has only a fraction of a horse power, but of course one of almost any power could be made on the same plan. The materials for the small one including boiler would cost three or four dollars. The cost of materials for a larger one would depend of course upon the size.

(7998) H. C. C. writes: In the article on "The Electric Chime," I do not quite catch the portion relating to the cam and lever. And will you describe a little more fully how made, what made of, and how connected to the wire. A. The cam is made of two plates of brass, one sawed out to form the double groove and soldered to the other. The lever simply makes a connection between the two springs when the cam pushes it between them.

(7999) W. & Co. ask: Would the mandrel-drawn steel tubing mentioned in a recent article in your paper be suitable, without boring, for steam cylinders up to a diameter of, say, two inches? A. The cold-drawn steel tubing is true and suitable for small steam cylinders.

(8000) G. G. P. asks: Has there ever been a relay or repeater for the telephone invented by any one? If so, will you please give a general description of it, so that the principle upon which it works may be understood by your readers. A. Yes, there have been several invented. The idea is to connect the receiver of one line to the transmitting microphone of another, so that the message as it is received shall be immediately transmitted along the second line. Miller, "American Telephone Practice," price $3 by mail, has a chapter on this topic, giving the various methods by which it has been attempted to accomplish this very desirable object. Of the relay Miller says: "It has not shown its ability to transmit speech between two distant points any better than or quite as well as could be done by direct transmission without the use of the relay at all." That is the condition of the problem to-day.

(8001) J. C. H. asks: What fluid is used in Edison-Lalande battery? A. The fluid is caustic soda or caustic potash, 30 or 40 parts in 100 of water.

(8002) E. H. asks how to make a dry battery to run a small motor? A. The plates of a dry cell are zinc and carbon as in all Leclanche cells. The dry cell is a Leclanche cell with some porous material in which the liquid is held absorbed so that it will not run out. The liquid may be only a solution of sal ammoniac. The absorbent may be plaster of Paris, mixed with something to make it more porous. In some cells this is oxide of zinc. Most of the dry cells are made by secret formulas. The cell itself is made of zinc. The carbon usually occupies at least half of the space in the cell. One formula is said to be: oxide of zinc, 1 part; sal ammoniac, 1 part; plaster, 3 parts; chloride of zinc, 1 part; water, 2 parts; all by weight.

(8003) L. F. asks: What is the candle power of ordinary coal oil lamps having wicks ¾, 1, 1¼ and 1½ inches wide, and a student lamp having a wick 2¾ inches in circumference? A. The candle power of these wicks varies greatly in different burners. The only way to proceed is to measure each lamp when it is in its best condition. The results will be from 5 to 50 or perhaps more candles. Nearly every text book of physics describes the method of measuring candle power. Avery's "School Physics," price $1.40 by mail, is a good guide in the experiment.

(8004) P. S. asks: I would like to make a dynamo out of the "Simple Electric Motor" described in Experimental Science (page 497). How many volts and amperes can I expect from it? How many incandescent lamps, and what candle power? When wound as a dynamo, can I use it as a motor? Have you a SCIENTIFIC AMERICAN SUPPLEMENT describing a dynamo and motor that will light some incandescent lamps and is very simple and easy to make, as I have not very many tools? A. 1. The simple electric motor is a dynamo if it be driven by an engine. Every dynamo is a motor when electric current is sent through it, and every direct current motor is a dynamo when driven by power. It will give nearly the same current as is used to drive it, and will light a few small incandescent lamps. 2. The simple electric motor is the easiest to build without a machine shop. The dynamo described in SUPPLEMENT, No. 600, is able to light eight 16 candle power lamps of 50 volts.

(8005) P. D. B. asks: Will you please publish a recipe for making batteries to be used upon a gasoline motor bicycle? A. A good dry battery is best adapted to igniting the vapor in a gasoline engine. These can be purchased much cheaper than they can be made. Their construction can be learned from Carhart's Primary Batteries, price $1.50 by mail. A storage cell is described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 792, and the Electric Ignition of Gas Engines is the subject of a valuable article in SUPPLEMENT 1281.

(8006) H. G. V. L. asks: 1. Which is the best for X-ray screens—barium platinocyanide or tungstate of calcium? A. Barium platinocyanide is better for fluorescent screens than calcium tungstate; by some it is pronounced to be 75 per cent better. Its chief point of superiority is that it does not retain its glow so long after the rays have ceased to strike it as calcium tungstate does. 2. Where can barium platinocyanide be had, and what quantity would be needed to make a screen say 8 by 10 inches? A. Either of these substances can be had from dealers in X-ray apparatus. See our advertising colums. The dealer will tell you what quantity to use per square inch. 3. Have an actinometer with scale from 0° to 80°. Do not know how to get the specific gravity, say sulphuric acid 1·82, or sulphuric and water, for electrolytic breakers or batteries? A. Put your actinometer in sulphuric acid of known density, or in a mixture of the proper proportions, and observe the reading. Afterward it will only be necessary to bring the fluid to the density which will support the actinometer at the same mark.

(8007) McK. asks: Why are our prevailing winds westerly? The earth's revolution would naturally cause the winds to blow in the opposite direction. A. The prevailing winds of your part of the world are westerly because you live in the zone of the anti-trade winds, which prevail from 30° to 60° north and south latitude. Winds are not caused by the earth's rotation on its axis. They are modified in their direction by that rotation. They are caused by the heat of the sun. The subject is too extensive for treatment in a note. The reader is referred to Waldo's "Elementary Meteorology," price $1.75 by mail; and for a complete presentation of the subject to Ferrell's "Treatise on the Winds," price $4 by mail.

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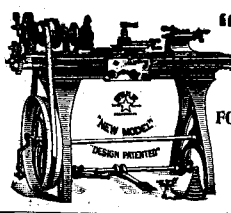

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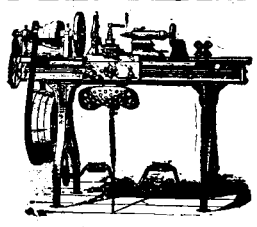

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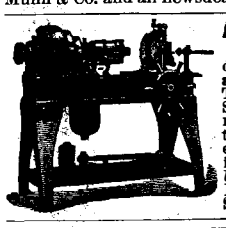

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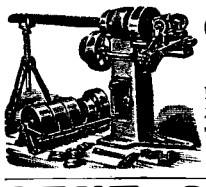

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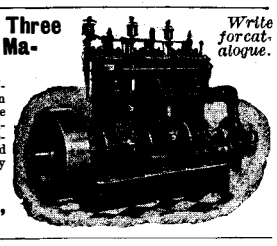

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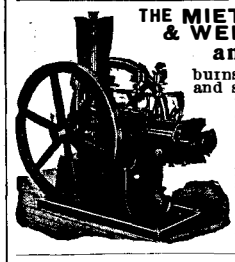

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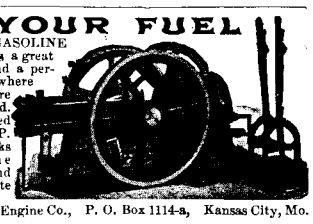

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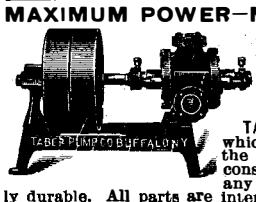

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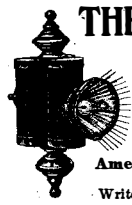

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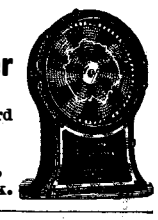

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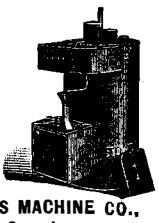

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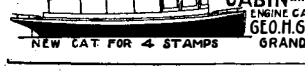

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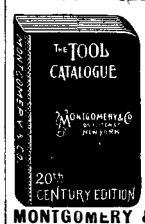

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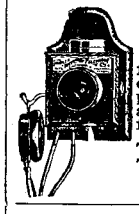

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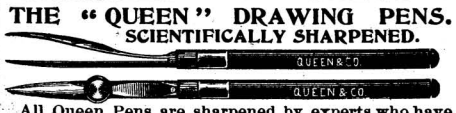

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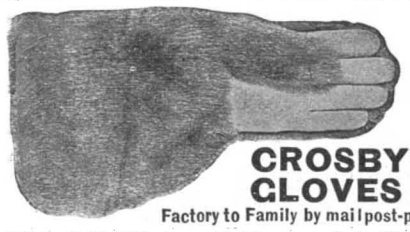

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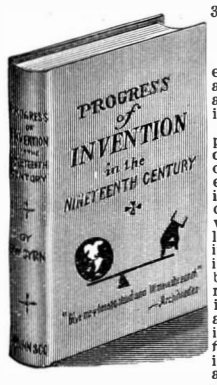

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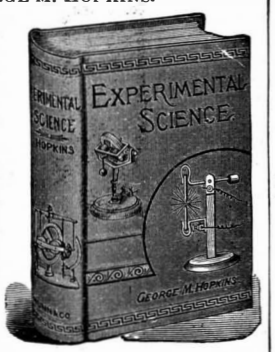

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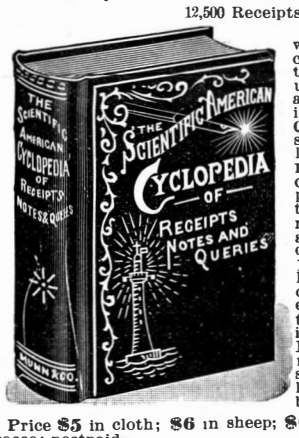

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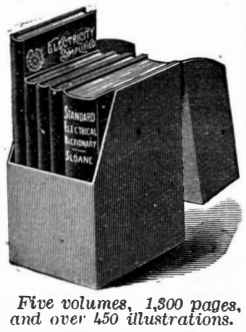

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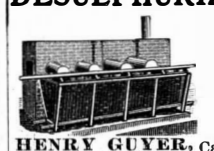

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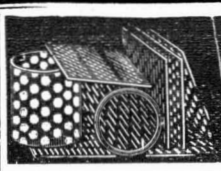

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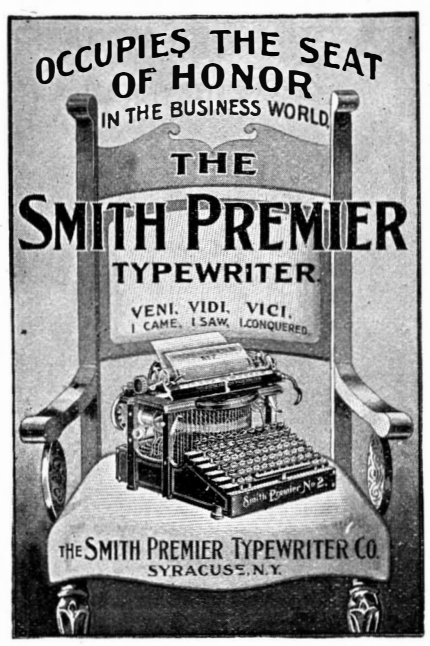

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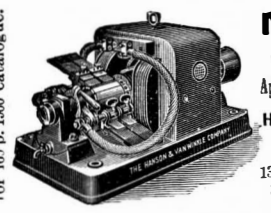

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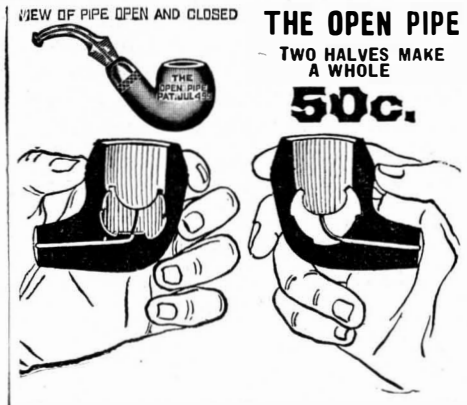

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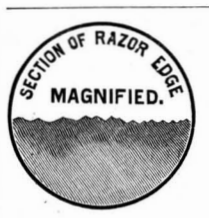

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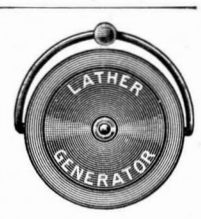

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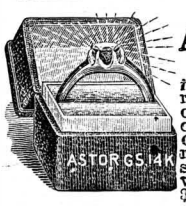

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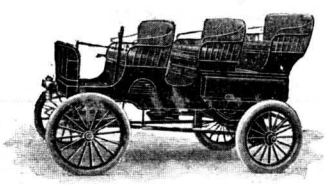

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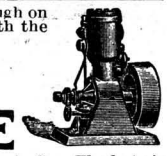

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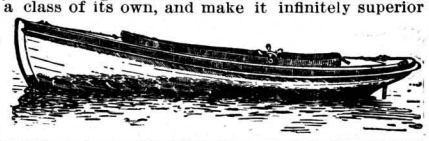

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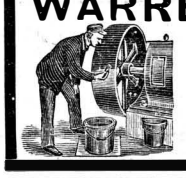

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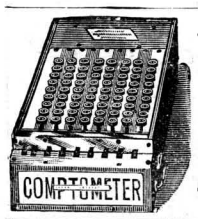

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